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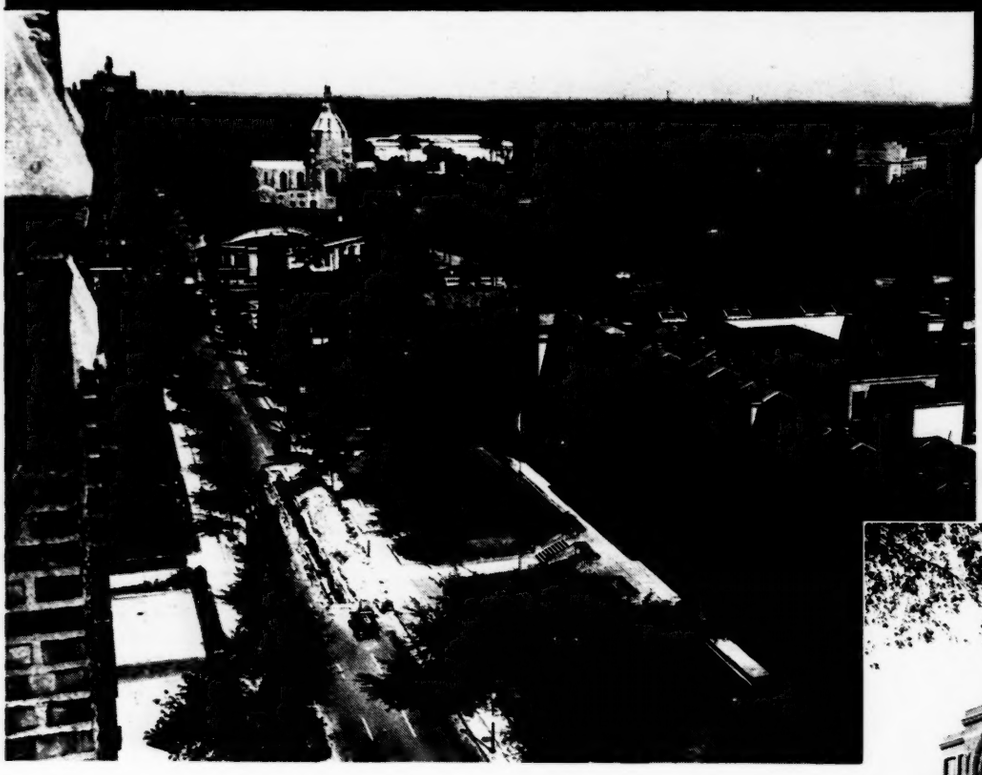
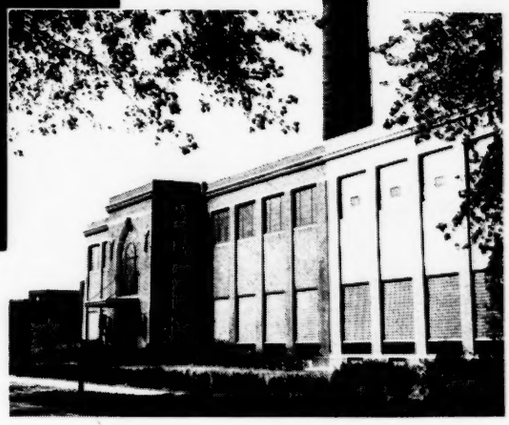


A partial view of the area served



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A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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The INDUSTRIAL PRESS

THIS MONTH'S COVER

Set-up in a moderate size studio during the televising of a program. Equipment includes three cameras, two mike booms, and, in the foreground, the sound equipment. Two air supply outlets are visible in the upper part of the photograph. For data on air conditioning details, see page 57.

F.E. Myers assures

SAYS MR. C. GINN, Vice President and General Manager of the F. E. Myers & Bro. Co., one of the leading water pump manufacturers: "We regard the use of standard motors for pump and water system service as an important advantage to our customers. Motor exchange plans, made possible by the use of standard motors, enable the user to get his pump back in operation with a minimum of delay. Any interruption of water supply is serious and, if extended, may be disastrous, especially to farmers. The use of standard motors and consequent ease of replacement and service is a big talking point for our products."

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Washington News

LORING F. OVERMAN

WASHINGTON—particularly Congress—appeared in somewhat of a dilemma as April merged into May.

On one hand, members of Congress were faced with the necessity of doing *something* with the voluminous legislative program docketed. On the other, each passing day was making it more difficult to know just what to do.

And pressing for action is President Truman with his reminder of campaign promises, plus the threat of a summer legislative session if the legislators do not get into high gear quickly.

Things have not yet reached the stage where there is a danger of passing just any kind of legislation in order to have something to show. That danger will come as the summer recess date approaches. In fact, facing deadlines may turn out to be the only means of getting any important legislation through the present Congress. To date, that is the pattern. The rent control law was renewed at the last possible moment, it will be recalled. Outside of that, nothing at all controversial has gotten beyond the preliminary discussion stage.

As Congress ended its short Easter vacation during the closing week of April there was evidence that, controversy or no controversy, early action was due for some measures, particularly those not too greatly affected by possible changes in the business picture.

The housing bill, for example—complete with multi-billion dollar provisions for public housing—went sailing through the Senate with little opposition, the vote being 57 to 13. Although a similar bill, on two previous occasions, has been passed by the Senate, only to fail of passage in the House, there were indications that things might be different this time.

It isn't that provisions of the bill are any less controversial than they ever were. But instead of being considered largely inflationary, the housing bill is now being viewed as a possible additional stop-gap in the event some brake is needed for deflationary tendencies.

As passed by the Senate, the bill would help authorize one billion dollars in loans and half a billion in grants to help cities get rid of slums. It would also distribute federal contributions toward the building of 810,000 low-rent public housing units during the next six years to replace the slums. These contributions would start at $85,000,000 the first year, and could reach a maximum of $308,000,000 per year, in gradual steps.

The bill contemplates an average of 135,000 units a year. In boom times the President could reduce the number to 50,000 a year, or during a recession he could boost the number to as high as 250,000 per year. During the six-year period, however, the total could not exceed 810,000 units.

Recession Brake

It is this recession braking feature that seems to be intriguing Congress, for there appears to be growing conviction in Washington that inflation has run its course.

This conviction is complicating the Washington legislative outlook tremendously. A few months ago it was simple to promise labor its head in the way of wage-increasing concessions. It was easy to promise continuing high prices for farmers, and to hint price controls and allocations of scarce materials. It was popular to talk of higher minimum wages and broadened coverage by overtime provisions of the Wage-Hour law. Increased social security benefits, aid to education, government health programs—all sorts of benefits to be financed out of "excess profits"—were the style.

President "Optimistic"

Although President Truman continues to live up to his promises to put such ideas up to the Congress, there are indications that Congress is more and more inclined to accept them with a grain of salt. There are many in Congress who feel that the time has come to do one of three things—cut government expenses, raise taxes, or prepare for a period of deficit spending as a recession brake.

Cutting expenses materially, even under presently authorized programs, is both unpopular and unproductive of major results. Tax increases are equally unpopular, particularly when there is some question as to just which way the national economy is heading. Congress is more familiar with deficit spending as a means of bolstering sagging economics. Thus, the housing program, arms for Europe, national defense and similar causes too big to be handled on a pay-as-you-go basis tend to get the nod despite any trepidations members of Congress may have as to what the economic future may hold. On such projects the reasoning seems to be, "If we don't take care of these things, it won't make any difference anyway."

Weather-Vane Turns

To date, any within-Government prophets who may have voiced a word of caution have been pooh-poohed, but during April there was evidence of a veering wind. The Bureau of Agricultural Economics became the first important Government bureau to take official cognizance of signs of change. The BAE, in a new forecast for the last half of the year, has made a 10% downward revision of its earlier estimates of consumer buying power and employment, particularly during the last quarter of 1949. Some Washington observers were taking this as a signal that by mid-year the official government emphasis will be on deflationary measures. Meanwhile a Congress which is already sensing the trend, is being asked to vote as though it had no eyes for weather-vanes.

In considering subjects which might result in reg-

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all

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In institutions of this type, every dollar of maintenance is a dead load on the operating budget, and the only truly economical material is the one that will serve the longest. Wrought iron has definitely established its superior service qualities in hundreds of installations. Surveys in various sections have revealed case after case where wrought iron is still on the job after outlasting low-first-cost materials two—three—and even four to one.

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CORROSION COSTS YOU MORE THAN WROUGHT IRON

ular or "fixed" government expenses, Congress appears reluctant to be stampeded. It cannot overlook home area reports that industrial buyers are slowing down their purchases of lead, zinc and copper; that steel prices have begun to weaken, with cuts of both production and prices amounting to from 10 to 15 percent forecast for fall; that unemployment totals are climbing, and that the market for higher priced houses seems to have sagged.

With these and other factors in mind, Congress—even as you and I—may perhaps be pardoned somewhat for desiring to await some clarification of the economic crystal.

Whither Washington?

Trouble with any such a desire on the part of some members of Congress, however, is that what Washington does about it, one way or the other, will determine the trend, rather than reflect it. Thus it may be assumed that if the present settling continues or becomes more marked, Washington planners will rush in with any number of formulas "guaranteed" to bolster the sag before it reaches the serious stage. It is to be hoped that such formulas will be successful, for it may be assumed that if emergency remedies appear necessary, pressure from the home areas for Congress to "do something—anything," will be too strong to resist.

There have been no reports in Washington of any overall "Operation Sag" plan being in readiness, but there are half a dozen piece-meal plans which, with a little pressure from the affected groups, could channel some billions into the economy via said groups.

Veterans' bonus, for instance, could be quickly revived.

The housing program could be quickly expanded.

Increased national defense expenditures would help the heavy industry situation, the aviation and shipbuilding industry, transportation, and so on—not to mention opening new employment in the armed forces.

Federal aid to education, considered likely only as a door-opener at the present session of Congress, could be enlarged to produce a market for quite a lot of things—including air conditioning—as could a national health and hospital program.

As for the proposed new farm program of subsidizing farmers on a guaranteed income basis instead of on the basis of price supports, such a project could doubtless be cleared with little difficulty as an emergency measure. Likewise a renewed dole, expanded social security payments, and so on down the line.

The windup would be that, as the price for bolstering a sag, the nation would find itself shouldering all of the federally financed programs in the books, together with the individual controls that go with a controlled economy.

It is with just such undesired eventuality in mind that cool heads in Washington—some in Congress, some among the much-maligned lobby groups, and some in the Administration itself—are working tirelessly to arrive at logical conclusions before emergency measures become necessary.

Exponent of the unpopular principle that economy within government itself is the necessary alternative to emergency measures is the Hoover Commission on Organization of the Executive Branch of the Government. Admitting the necessity of military preparedness, the Commission nevertheless has told Congress that waste in military spending is "startling" and that such expenditures are seriously imperiling the national economy. Specific examples were cited to prove the Commission's point, and Congress was reminded that it allocates billions of dollars for defense without accurate knowledge as to why the money is requested or the purpose for which it is being used.

How unpopular this word of warning is, even to members of Congress who face such tremendous national responsibilities in the weeks to come, is the fact that little progress is being made in adopting any of the steps which the Commission has estimated would save billions of dollars in federal expenditures.

Perhaps even more significant than the Hoover Commission's observation is the fact that a warning voice has been raised from within the ranks of the Administration itself. Edwin Nourse, chairman of the President's Council of Economic Advisers, has also warned that spending plans of the military should be placed under a ceiling. He admits alarm over present financial conditons. To date, his appraisal of conditions has gone unheeded.

Still insisted upon by the White House is a tax increase and, while Congress has resisted this approach consistently, leaders are beginning to concede that some additional fund-raising may have to be ordered if present "must" programs are to be approved.

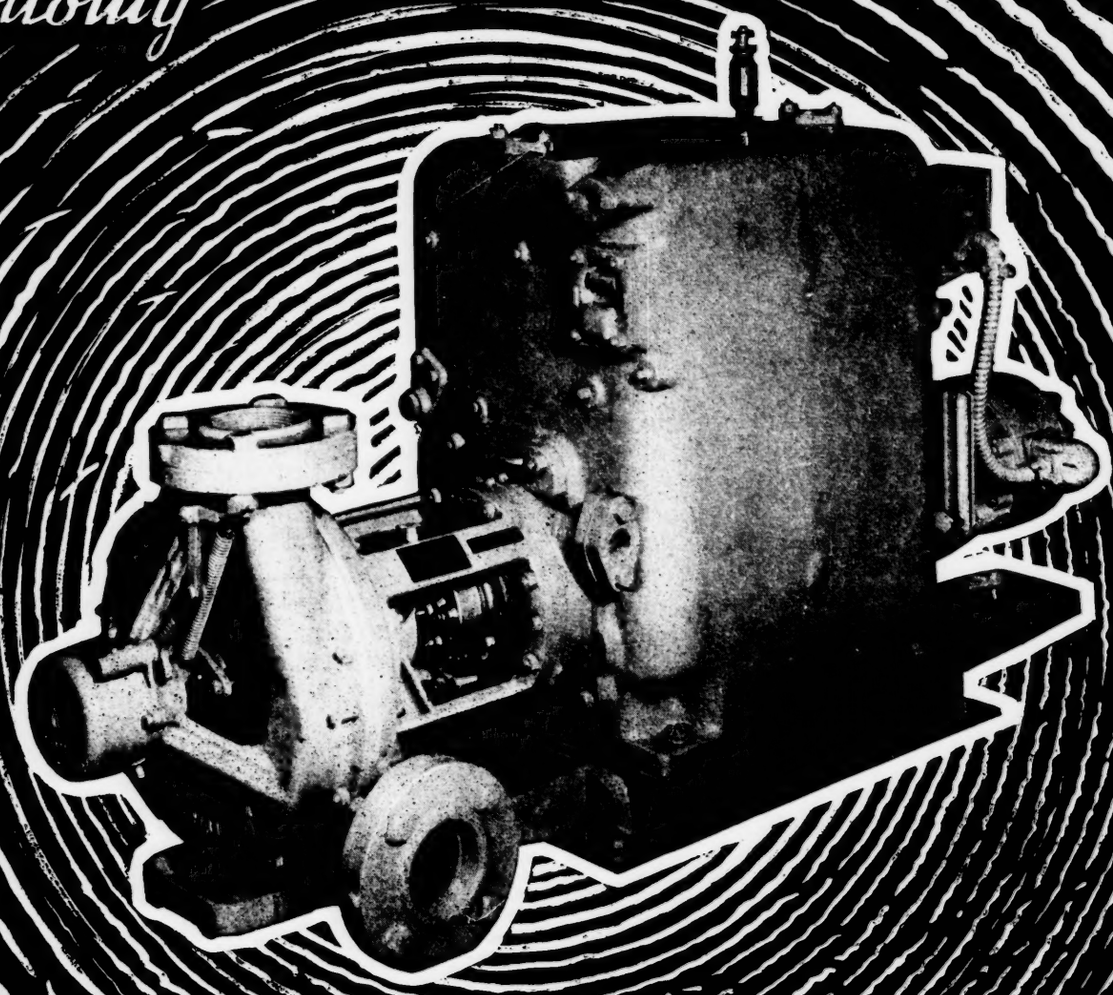
Labor Power Waning?

As the House began consideration, on April 25, of proposals to either repeal or amend the Taft-Hartley Act, it was evident that Congress was not ready to rubber-stamp the wishes of CIO and AFofL. It could be that the veering weather-vanes has caused some in Congress to give some extra thought to the viewpoints of those who provide the jobs to pay the wages to pay the taxes to run the house that Jack built.

In any event, it was considered unlikely that the Administration-promised Lesinski bill (repealing Taft-Hartley and re-enacting most of the provisions of the Wagner Act) would squeeze through in its initial form. Nor was it expected that many in Congress would hold out long for the present law, as such. Considered more plausible was a stand for the Wood bill, introduced by Representative Wood, Georgia democrat, to retain many of the provisions of the Taft-Hartley law.

Labor is complaining that the Wood bill would merely re-enact the Taft-Hartley Act under another name, and strong opposition is certain. Observers were confident, however, that any labor law passed would not return labor-management relations to the Wagner Act status of 1935-1947. Instead, they anticipated that standards of conduct for both employers and employees would be prescribed; that injunctions would again be authorized to halt emergency srikes during negotiations; that penalties would be provided for picketing violence, and that a waiting period would be required before strikes may be called.

Centralized Heating Economy



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AIR CONDITIONING A TELEVISION STUDIO PLANT

Air supply outlets in this intermediate size television studio are indicated by arrows. Stage sets add to the problem of pre-planned routes of air flow. All photographs, courtesy National Broadcasting Co.

C. A. RACKEY* and R. T. KEOWEN†
National Broadcasting Co.

Problems affecting the cooling of television studios and technical spaces are described. Attention is directed to the manner that such air conditioning differs from standard comfort cooling practice.

A TELEVISION studio plant of network caliber consists of the following:

(1) Live talent studios
(2) Projection studios for motion picture film and slides
(3) Control booths associated with (1) and (2)
(4) Master control room
(5) Main equipment room
(6) Commentators' booths
(7) Technical test and repair shop
(8) Miscellaneous non-technical spaces as, dressing rooms, scenery shops, scenery and property storage rooms, rehearsal rooms and, of course, offices for the staff administering and operating the plant.

In smaller plants, especially those having a single studio, the number of separate spaces may be reduced, as, for example, by combining the control booth, master control and main equipment room. However, these changes do not substantially affect the air conditioning techniques involved.

The problem of air conditioning television studios is, in many respects, similar to that encountered in cooling monochrome motion picture studios. There are, however, the following differences:

(1) Basic capacities must be somewhat greater since work periods under lights are substantially longer than in motion picture practice. Television, being required to produce a continuous flow of fresh material, does not have the preparation time available in motion picture production. In most cases, a rehearsal under lights is followed, either immediately

*Manager, Audio-Video Engineering.
†Head, Air Conditioning Operations Staff, New York.

or soon thereafter, with an on-the-air show. Other rehearsals and shows are tightly scheduled in available intervals with the result that the lights are in practically continuous use the entire operating day and very small advantage can be gained by resort to pre-cooling.

(2) Studio equipment heat loads are substantially in excess of any encountered in motion pictures, and are confined. The video gear in a typical studio—consisting of three cameras and associated control, switching and monitoring units makes a sensible heat load of 5,000 to 10,000 watts, the bulk of which is in a comparatively small control booth.

A diagrammatic representation of the technical spaces comprising a television studio plant, with an indication of the principal air quantities, is given in Fig. 1.

A television studio is a space in which a live talent program is produced. The production of this program utilizes actors, scenery, the usual stage properties, lights, television cameras and, possibly, some television picture monitors by which those in the studio, who are responsible for lighting and stage direction, may check the actual setup without the trouble of going into the control booth. Studios vary in size; 30 ft by 60 ft by 16 ft high might be considered an average size. One 15 ft by 30 ft would be rather small; 75 ft by 100 ft by 25 ft high a large one.

An attempt is generally made to obtain as much soundproofing as possible, either by using relatively massive partitions, tight construction, or by resorting to floating walls, or floors or ceilings, or all three. Acoustic treatment, by generous application of sound absorbing materials of various sorts, is essential in order to control normal room acoustics and to counteract the reverberance introduced by scenery and hard properties. Type of construction, soundproofing and acoustical treatment together combine to make a space that is practically air-tight and heat insulated to a greater degree than ordinary spaces.

The primary load-producing elements within a studio are the lights used to illuminate the sets. In an average sized studio, all other loads (other than transmission or solar loads) are minor in comparison and can often be ignored.

Studio Lighting

Fortunately for television, there have recently been developed television picture pickup tubes (Image

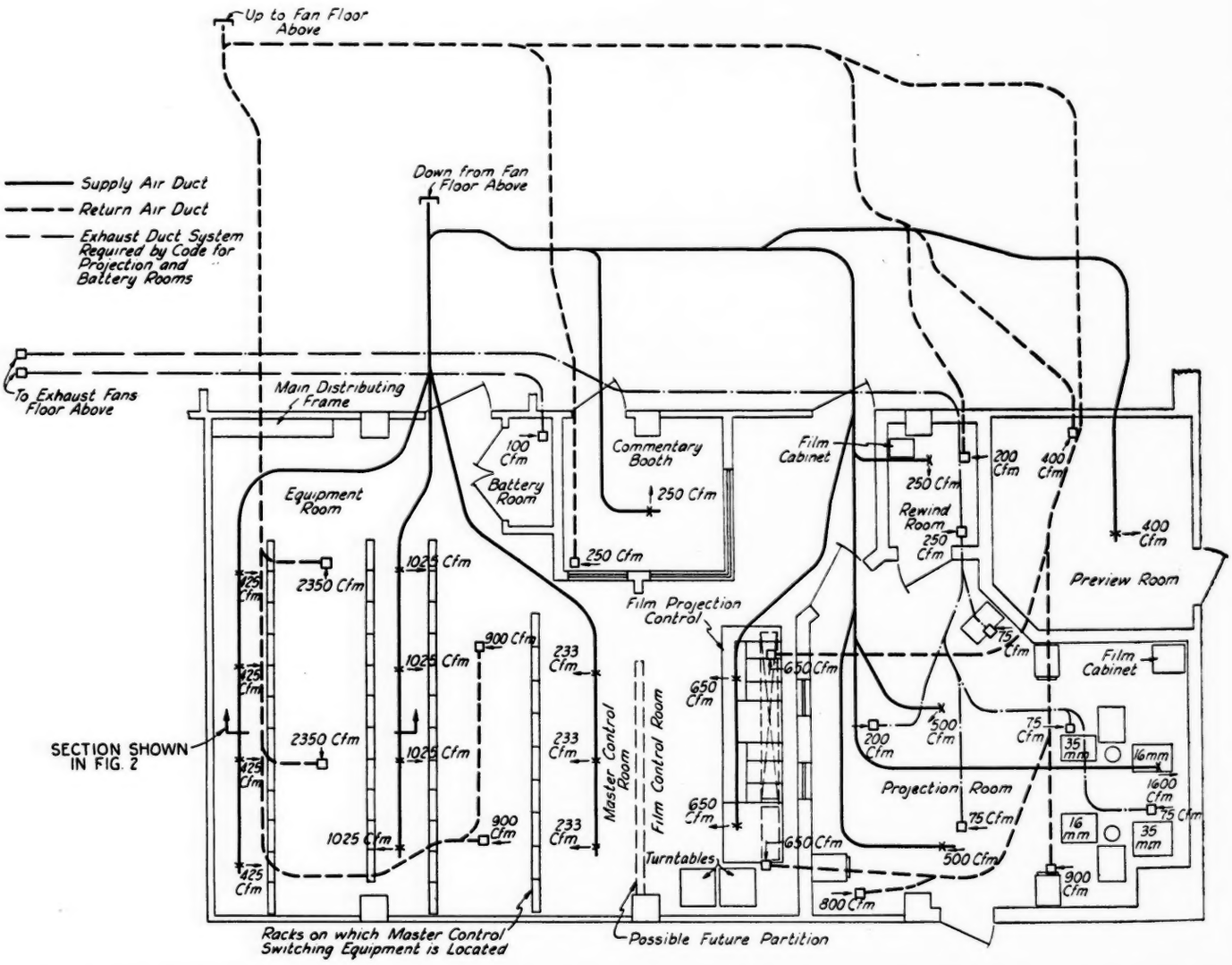


Fig. 1. Plan of typical television master control and film layout showing master control racks, film control console and special rooms. Conditioned air supplies and returns are indicated.

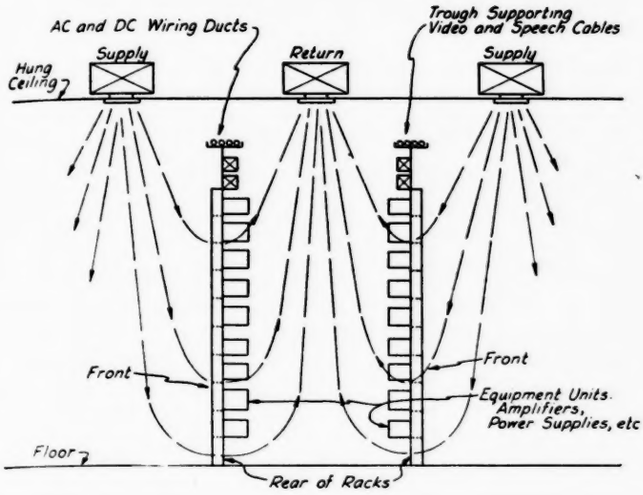


Fig. 2. Method of routing cooled air for heat removal from units in the equipment room rack section.

Orthicons) which are several times more sensitive than the original Iconoscopes by means of which practical television was introduced. These latter tubes required 500 to 1000 ft candles for good operation, a truly broiling ordeal for the actors forced to work in illuminations of that level. Image Orthicons in use today operate in a range between 100 to 200 ft candles of incandescent light. Lesser light levels than these sometimes are used but it is unsafe to use a lesser figure for design purposes.

The question of fluorescent lighting may here be considered in that this type of lighting is more efficient in light production and more nearly matches the response characteristic of the average studio type Image Orthicon. This gives an overall increase in usable efficiency of roughly two to one. There is, however, the following "catch" to be considered—the fact that present techniques in lighting seem to call for a mixture of fluorescent and incandescent in which the fluorescent units (not being adaptable to much optical control) are used generally as base or key lighting, with incandescents filling in to a considerable degree to obtain modelling or dramatic effects by means of spots, scoops and the like. In the end, light of higher efficiency tends to be more generously used and this, together with the necessity for large amounts of controlled light presently obtainable only from incandescents, indicates that, at least for the present and the near future, design constants for incandescent light should be used.

Another factor enters into the picture at this point—the matter of lens aperture or stop. Comparatively large lens apertures are used at present in order to get maximum picture signal from present light levels. Large lens apertures, however, reduce depth of field and are thus a present limit on camera operation. A 100% decrease in aperture does not have too great an effect on depth of field yet, but from a heat load standpoint it involves providing twice the refrigeration capacity. As light efficiencies increase or as picture tube sensitivity increases, smaller lens apertures will come into use, therefore, again tending to maintain present light levels. Another way of putting this matter is to say that, in the not too distant future, light levels will tend to remain at maximum limits for reasonable personnel comfort—which is about 100 to 200 ft candles, based on the use of incandescent tungsten light.

Therefore it seems that a reasonable unit load figure for lighting television studios is 40 watts per square foot, with a use factor of about 50%. Forty watts per square foot to obtain 200 ft candles of incandescent tungsten lighting is a safe outside figure and includes various inefficiencies in reflectors, diffusers, lenses and the like. The use factor is based on the assumption from experience that not more than half of the entire studio will be in actual use at any one time. This use factor may be varied somewhat ac-

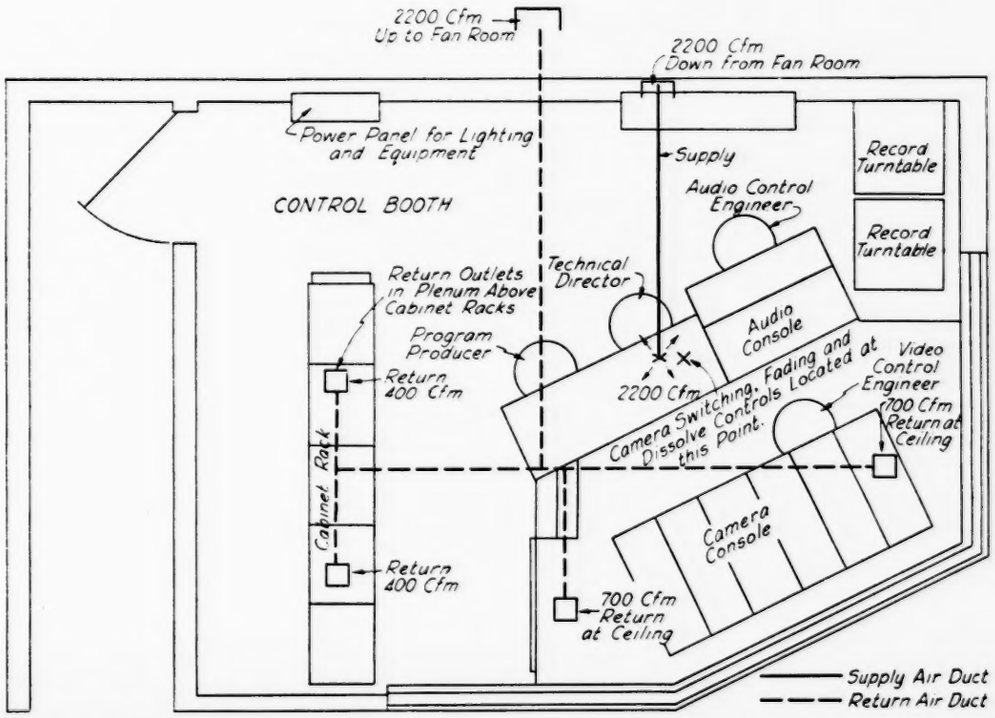


Fig. 3. Typical television studio control booth showing the location of principal equipment and personnel.

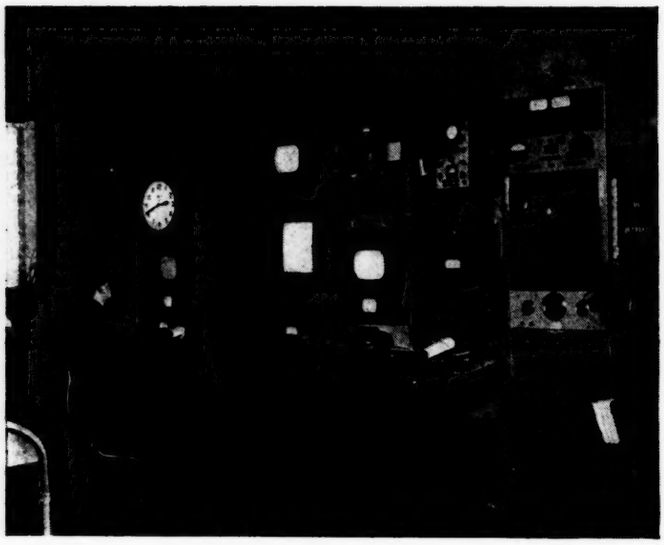


Fig. 4. View of the master control board. At this point is located the monitoring, testing and program switching equipment. The rear view of this board is shown in Fig. 5.

cording to the size of the studio. The larger the studio, the smaller the use factor, generally.

Studio Ventilation

With respect to the manner of introducing the air, no special problems exist other than, possibly, that it is an advantage to introduce the air somewhere in the region below the average level at which the lights are hung in order to avoid heat pickup from the mass of heated air pocketed in the upper regions of the studio. This suggests also the value of a separate exhaust to draw off some of this upper level heated air. It is not usually feasible to introduce air at floor level as scenery setups tend to interfere with planned air flow. Concerning returns, they should be generous in size and number, a few at floor level but most of them at the ceiling since not all the air actually gets down to the floor. The average television studio is about 16 ft or more in height and the bulk of the lights are hung at a level of 10 to 12 ft above the floor.

With respect to air temperature within the studio, an average of 72F for winter operation, with standard design practice for summer differentials, to a maximum of about 80F, is satisfactory. A maximum 20F spread between entering air and room temperature is also good practice. Reasonable precaution against drafts should be taken as the performers under the lights tend to perspire somewhat and when moving away from the lights between periods may become dangerously over-cooled.

Sound control of air conditioning is, in general, not as critical as with standard broadcasting studios since there seems to be an irreducible minimum of noise in television staging. However, entering air velocities should not exceed 500 to 600 fpm; returns 250 to 350 fpm. Both supply and return ducts should be lined with suitable acoustic material approximately a minimum distance of 16 ft back from either supply or return grille. Other than this, the general practice of sound control, mechanical and air-borne, used for sound studios with possibly some relaxation should be followed.

Control Booths

Control booths, Fig. 3, are a special problem. At present it is not completely solved, since the bulk of the heat producing television equipment (the camera control units, picture monitors and audio equipment) is located therein and because the booth volume is comparatively small. An average control booth is about 15 ft by 10 ft by 8 ft high and the sensible heat load therein 6 to 10 kw. The average personnel load is about five to eight persons or more, depending on how many additional observers an important client or advertising agency might see fit to introduce therein. A reasonable normal personnel complement is a video engineer, an audio engineer, a producer, an assistant producer and a technical director, and one or more casual observers. The principal problem with personnel is not their heat production but problems inherent with smoking. This is, and always has been, difficult to control or to eliminate technically in spaces of small relative volume.

The ideal technique for a control booth is a dual system in which air is separately introduced for personnel comfort and for equipment cooling. Equipment can safely be operated in an ambient of 100F D.B. and should, if possible, be so installed and isolated that air can be separately routed through it. Unfortunately except with rack type equipment, present television equipment is not especially designed to make this a simple procedure and this leaves room for individual ingenuity—and for better design with respect to heat venting on the part of the equipment manufacturer. Radiated heat from the equipment is a substantial factor in personnel discomfort. Where possible, insulating and reflecting shields should be interposed to reduce this radiation since, otherwise, no reasonable amount of cooling can counteract it. Where economy is necessary, the air should be introduced primarily

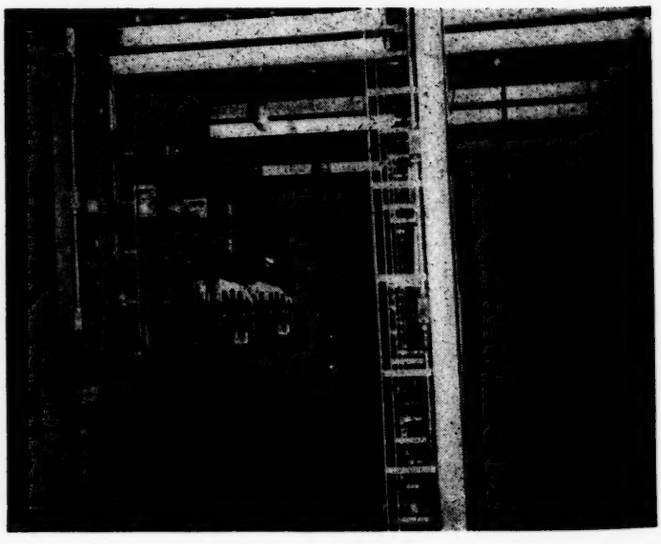


Fig. 5. This is the equipment that is cooled as indicated in Fig. 2. At left is the rear of the master control board. Other equipment is racked up in bays to the rear of the master control board.

for the comfort of the operating personnel, thereafter pulling the room air through the vicinity of the equipment before returning it to the system. Lighting loads in control booths are inconsequential. Two watts per square foot is sufficient and, during actual operation, the room is usually darkened and small script-reading lights used.

Projection Studio

In a projection studio are located the 35mm and 16mm projectors, various still projectors, and other optical devices used to project, on the picture pickup tube, images of slides or opaque objects for advertisement or test pattern purposes. Sometimes the pickup cameras and often one or more monitors for the use of the projectionist are also located in the projection room. If 35mm motion picture film is used, the construction and ventilation practices are governed by the local and national codes having jurisdiction. It is difficult to give a unit figure on heat loads of a projection booth since this depends on the amount of equipment installed in the booth. A network broadcaster might require 8 to 12 kw; a smaller station with no 35mm equipment about 5 kw. The personnel load is a minor matter; usually one or two projectionists. Illumination for a projection studio is similar to that of a control booth and, in general, the control booth and control equipment for a projection studio is essentially similar to that of a live talent studio. Therefore, specific description of air conditioning problems is superfluous.

Master Control Room

The master control room is a space wherein is located the equipment for dispatching the program output of a television plant to a network or a local transmitter, or both. Here also is located equipment for receiving and processing programs coming from outside the plant, as from a "field" pickup or a network. Technical test and measuring equipment usually complete the assembly. In larger plants, the master control room usually contains only the control and monitoring elements as push-buttons, picture monitors and loudspeakers. The bulk of the equipment is located in a separate equipment room, usually adjacent.

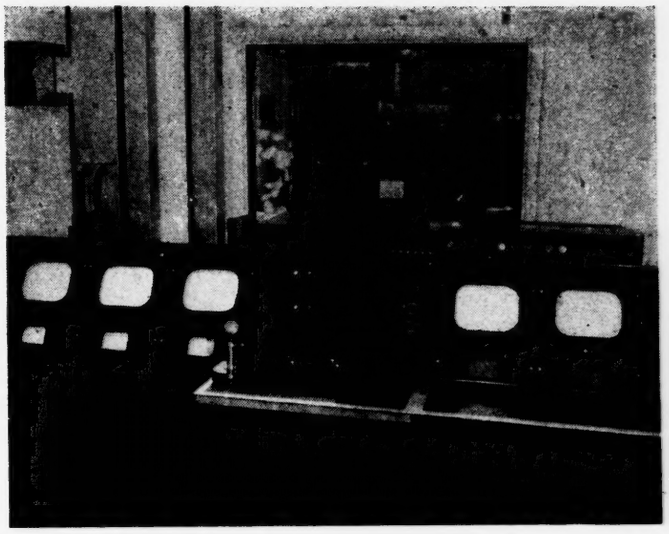


Fig. 6. Television film projection control console with film camera controls at the left. The technical director's switching position is at the center; pre-view and on-the-air monitors are at right facing producer's position.

With such an arrangement, a minimum of heat producing equipment is located where constant personnel supervision is required. Thus the equipment room can be treated as a separate space, conditional primarily from an equipment and not a personnel standpoint. When such an arrangement is possible, equipment can be mounted in racks, back to back, and air introduced primarily to cool the apparatus, since personnel attendance in the equipment room is only occasional. One of the means of doing this is to introduce air at the ceiling between rack faces, pulling it through apertures at the bottoms of the racks, drawing it up through the back to back enclosures and finally, exhausting it at the ceiling.

This completes a description of problems affecting cooling of television studios and technical spaces, stressing the elements of the problem that differ, perhaps, from standard comfort cooling practice. A complete television plant, of course, includes many other spaces than those used for technical equipment, but these are such that normal air conditioning practice can be applied and no special mention is considered necessary.

Device Designed to Plot Sun Angle

An ingenious device that can depict the angle at which the sun will shine on a house in any part of the world at any time of any day has been developed by Libbey-Owens-Ford Glass Company to aid architects and home builders in determining the width of roof overhang for correct shading of solar houses. The instrument, known as a solarometer, looks like something out of a planetarium.

It was developed to meet the ever-growing demand for information on how to build solar houses to take maximum advantage of the sun's rays, according to Frank Sohn, Libbey-Owens-Ford architectural consultant.

A prospective home builder can set the solarometer for any city in the world to work out his particular problem. Then the device sends a mechanical sun in an arc from dawn to dusk in the proper path for that latitude. The sun can be halted at any hour of the day. By adjusting the sun on a graduated scale, the operator can observe how its rays strike the glass areas of a model solar house during the summer and winter seasons.

Air Recovery in Aircraft Cabin Air Conditioning

R. L. LINFORTH
Boeing Airplane Company

Specifications for post-war commercial transport aircraft require a system to satisfy the basic functions of air conditioning, that is, the control of the velocity, temperature, humidity and quality, of the air within an enclosed space. In addition, the system must also control the absolute pressure within the cabin. Pressurization imposes upon the air conditioning system additional cooling and power requirements, and it is therefore highly desirable to maintain the pressurized outside air supply at the lowest possible volume commensurate with adequate ventilation. The following analysis and solution of this problem as applied to the Boeing Model 377 Stratocruiser exemplifies the basic requirements.

THE Boeing Stratocruiser is a medium-to-long range, four-engine, high altitude, high speed transport designed for operation at altitudes up to 30,000 ft. A figure "8" or double lobe fuselage provides compartments on two decks. Accommodations are provided for 75 day passengers or 67 night passengers, 24 in berths and 43 in reclining seats. The normal flight crew is seven. However, because of variable occupancy where a passenger may be in his seat or in the dressing lounge and a crew member may be in the cabin, the galley or the cocktail lounge, the ventilation requirements were based on a total occupancy of 90 people.

Structural requirements, fixed and uncontrollable air leakage from the body, and the power required to compress the air dictated the minimum cabin-to-outside pressure differential. Although the Stratocruiser can and will be flown at altitudes up to 30,000 ft, most of its operation will be at 15,000 ft. A sea-level cabin altitude at 15,000 ft could be maintained with a 6.5 lb per sq in. differential which would then provide an 8,000-ft cabin at 30,000 ft. Further, it was determined that the absolute pressures required

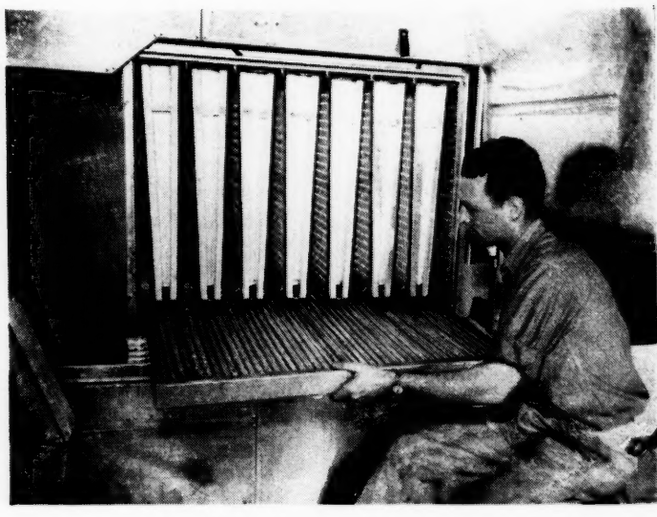


Fig. 1. Air recovery unit with activated carbon deodorizer being inserted by workman.

to provide this differential were available at the discharge of the main engine superchargers and that bleeding up to 20 lb of air per minute from each engine would not affect engine performance. In addition, this engine induction system is equipped with an intercooler and the heat of compression could be controlled by engine operation according to outside air temperature, i.e., removed when cabin cooling was required and supplied during the heating cycle. Thus, this already installed equipment was available as a cabin pressurization source.

Ventilation Air Requirements

Oxygen and Carbon Dioxide Control. If an equivalent altitude of 18,000 ft above sea level is not exceeded within the cabin, a ventilating rate of 5 cfm of outside air per occupant will supply adequate oxygen for the average airline passenger.

The carbon dioxide exhaled from the lungs, and its resulting concentration within the cabin must be considered. It has been established that CO_2 concentrations of not more than 0.5% have no effect on the human faculties. The control of this concentration in a sealed enclosure, such as a pressurized aircraft cabin, becomes one of dilution by fresh air and is affected only by the increased amount of exhaled air caused by increased respiratory function at lower absolute pressures. Assuming the maximum crew and passenger activity to be equivalent to a man walking at 2 mph, the ventilating rate to maintain this 0.5% concentration is 5 cfm of outside air per passenger at sea level, increasing to 10 cfm at approximately 16,000 ft.

Cabin Heating. Specifications required cabin heating capacity sufficient to provide a cabin temperature of 70F D.B. at —65F in flight or on the ground. Chosen for the heat source in this system are gasoline-fired combustion heaters. Each of these units weighing approximately 30 lb has a capacity of 200,000 Btu per hr with a temperature rise of 350F at an air flow of 500 cfm. Thus, two of these very efficient heating plants could well supply the maximum cabin heating load of 375,000 Btu per hr based on a ventilating heat loss commensurate with a ventilating rate of 1000 cfm.

Cabin Cooling. Cooling capacity to provide a cabin temperature of 85F D.B. at 100F outside air temperature, either in flight or on the ground, was also specified. To provide time-proven equipment, a gas cycle refrigeration system was selected. A design policy of maximum efficiency and minimum maintenance time established a minimum evaporator leaving air temperature of 45F, thus eliminating any off-time or heat transfer loss caused by frost formation upon the cooling coils. To satisfy the specified cooling capacity of 10 tons of refrigeration at this minimum temperature dictated an air flow of approximately 3000 cfm.

Air Quality Control. The elimination of all objectionable odors in passenger aircraft is mandatory for the prevention of air-sickness. Therefore, all of the ventilating air entering the galley, the cargo holds and the toilet compartment must be vented overboard. However, the reduction in absolute pressure surrounding a human body results in the release of objectionable body gases. In addition, smoking, which is objectionable to many people, must be made permissible to those who enjoy it. The provision of an odor level of "barely perceptible upon entrance from outside" could be maintained in the cabin if a ventilating rate of 40 cfm of air per passenger were supplied as a mixture of 30 cfm recirculated and 10 cfm outside air, with the recirculated air treated in an activated carbon unit with a by-pass factor not greater than 60%. In addition to the odor control, removal of the smoke haze must be provided.

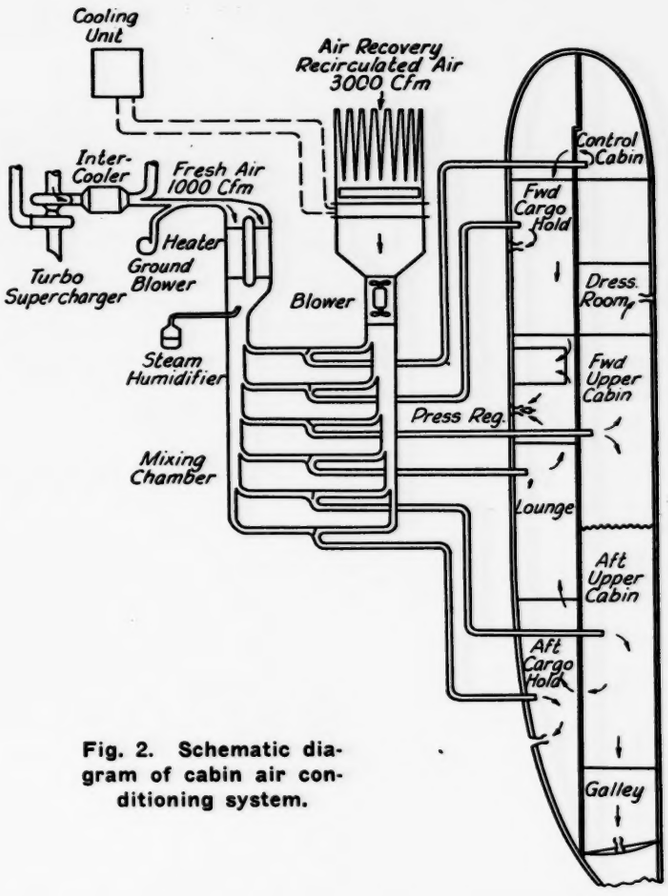


Fig. 2. Schematic diagram of cabin air conditioning system.

Temperature and Humidity Control. The optimum in compartment comfort is accomplished by elimination of heat gain or loss between passengers and surrounding walls and windows and by maintenance of ventilation air temperature very near the desired compartment temperature. By the introduction of the ventilating air through ducts formed between cabin insulation and inner lining material, and between double glazed cabin windows, this radiation loss can be minimized. Further, if air at approximately 120F is introduced at the bottom of the wall and allowed to travel upward, the wall adjacent to the seated passenger is at approximately body temperature. In addition, the heat transfer loss through the cabin walls is satisfied as the air proceeds to the top of the wall and can then be introduced at the ceiling at approximate compartment temperature. By utilization of the entire cabin ceiling area as an entrance grille, a downward air motion with a maximum velocity of 25 fpm can be achieved. To provide such a system in the Stratocruiser's cabin would require approximately 3600 cfm of ventilating air.

The various compartments and their functions presented a very interesting problem. In the night arrangement, for instance, the flight crew, surrounded by an extensive glazed enclosure on one side and heat producing radio equipment on the other, are quite active. Back in the upper main cabin 24 passengers are asleep in the berths; in the aft section of the cabin, separated from the forward section by heavy curtains, are 30 more passengers reading or dozing in the reclining chairs; the stewardess is in the galley preparing a late snack with her hot plate and coffee maker full on; and on the lower deck in the lounge 14 more passengers are having a night-cap; while in the cargo-pits may be flowers, live chicks or perishables. To satisfy the temperature requirements of each of these areas with no jeopardy to the required ventilating rate, dictated a dual temperature air supply.

For humidity control, moisture must be added during the heating cycle and removed during the cooling cycle. Weight limits the water available for warm air conditioning and, therefore, a minimum amount of outside air is desirable. Also because of weight, the only cool air dehumidification obtained is by condensation of water upon the evaporator of the Freon system. Thus, again, a minimum volume of outside air is desirable. Factors dictating the ventilation rate are summarized as follows:

(Based on 90 Passengers and Crew)

Oxygen Requirement	5 cfm per pass.	450 cfm
Carbon-Dioxide Control	7 cfm per pass.	630 cfm
Altitude Conditioning Leakage		
Fuselage Skin, Electrical and Controls	160 cfm	
Toilet Vents	120 cfm	
Galley Vents	120 cfm	
Cargo Compartment Vents	120 cfm	
Cabin Pressure Regulators —Minimum	100 cfm	
Misc., including Water and Hydraulic System Vents	180 cfm	800 cfm
Odor Control	40 cfm per pass.	3600 cfm
Compartment Temperature		
Heating	Maximum air 300F	1000 cfm
Cooling	Minimum air 45F	2000 cfm
Humidity	Minimum outside air	

The obvious system design satisfying these factors is a high ratio recirculating system with high efficiency air recovery, since the limiting factors are 3600 cfm total circulation for odor control including 1000 cfm of outside air for heating.

Air Recovery

The basic components for removal of smoke haze and odor are in daily use in both buildings and surface transportation equipment. However, these components, designed for low pressure fans, large available installation space, and without weight restriction (in terms of aircraft standards) were unsuitable for installation where every ounce and cubic inch is counted.

For example, several electro-static precipitating types of air filters were investigated and in actual test did an excellent job on the removal of tobacco smoke haze and dust particles. The power pack, however, would weigh at least 100 lb per 1000 cfm even after all possible replacement of steel with minimum gauge aluminum. Other devices of the non-electro-static types were tried and found wanting. This became a problem for Boeing development.

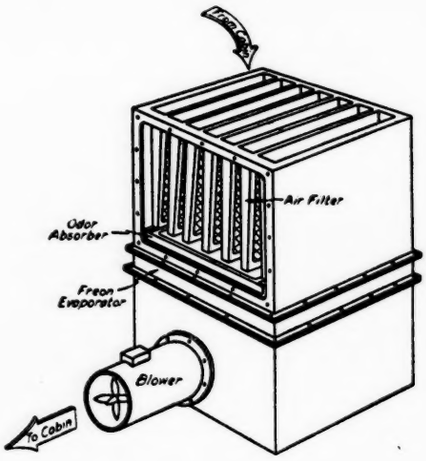


Fig. 3. Air recovery unit. Cabin air is drawn through V-shaped filters, activated carbon tray, and cooling coil for return to cabin.

After extensive testing on many types of filtering devices with the aid of the American Air Filter Company, a V-shaped filter using ½-inch thick fiberglas as the filter medium was found to do an excellent job. The V-shape provided a minimum of filter space and a maximum of filter area. Seven of these units, each in removable aluminum frames, weighed only 35 lb and were installed in a space approximately 26 × 26 × 5 in. The pressure drop through this assembly when passing 3000 cfm was 1.25 in. of water and their filtration efficiency in the removal of smoke haze and dust was very high.

The problem of odor removal was based on dilution with approximately a 3 to 1 recirculated-to-fresh air ratio, and treatment in an odor removal unit in the recirculating system with a by-pass factor not greater than 60%. An acceptable device for this requirement was activated charcoal in a unit weighing only 33 lb, developed by the W. B. Connor Engineering Corp. The unit occupies a volume of 36 × 25 × 2.5 in.

The final step was to design an air recovery unit in which the Trane evaporator of the Freon cooling unit was installed in conjunction with two Carrier aluminum compressors, and to make the recirculating air the cooling medium. The outside air, having passed through a standard air filter and thence through the combustion heaters, became the heating source. These two air sources were then mixed in the required ratios to supply the proper temperature air at the design ventilating rate to each compartment. Fig. 1 and 3 show this air recovery unit and Fig. 2 shows, schematically, the entire installed system.

The reasons for choice of the system described are the result of the selection of the main power plant turbo-superchargers as the cabin pressurization source, of gas-cycle refrigeration, and of a design policy to provide air conditioning equipment with time-proven performance and maintenance-free operation. In addition, it made possible the provision of full capacity ground operation independent of the main engines and of ground air conditioning trucks.

Tempering Replacement Air for Foundry Ventilation

The problem of tempering makeup air to replace contaminated air removed from the foundry of Federal Mogul Corp., Detroit, bronze bearing manufacturer, was solved by the installation of 10 direct-fired space heaters ducted in such a way as to take in, heat, and distribute 220,000 cfm of outside air.

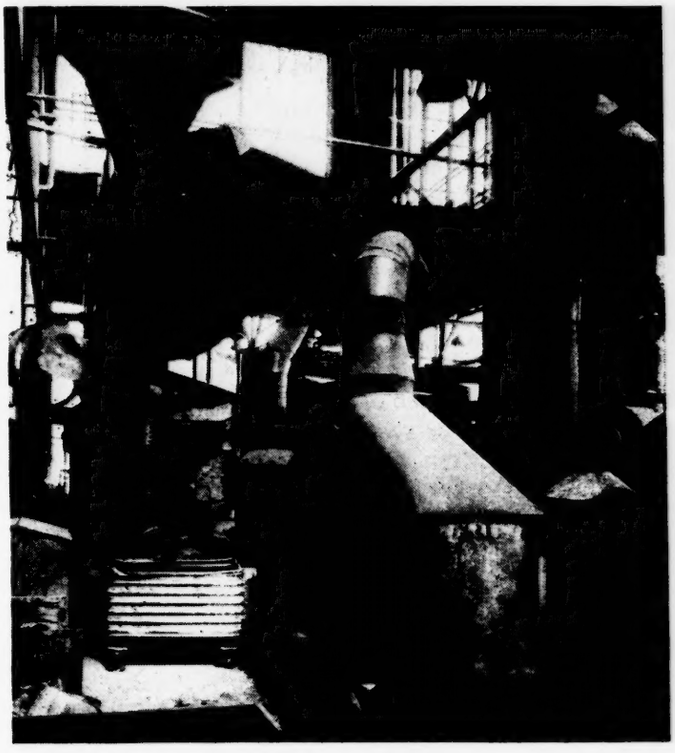
TO protect the health of employees, Federal Mogul Corp. uses a large amount of exhaust equipment in connection with operations that produce smoke, noxious fumes, dust and/or excessive heat. Among these are babbitt reclaiming furnaces, molding stations, bronze smelting furnaces, skimming stations, and grinders. At peak, approximately 400,000 cfm of air is exhausted from the large foundry building in an effort to keep the atmosphere free of contamination.

The foundry is 360 ft long and 120 ft wide with an average roof height of 30 ft. Because the volume of exhausted air exceeds that which can be brought into the building non-mechanically—by infiltration through the doors and steel sash windows—a satisfactory method had to be devised to equalize the air pressure throughout the foundry. This would be a relatively simple matter were it not for the fact that during the winter months, low temperature replacement air would chill the foundry and cause uncomfortable working conditions. The object, therefore, was to install equipment that could bring in sufficient quantities of tempered outside air to replace exhausted air while keeping the space heating load within the capacity of steam unit heaters which had been installed throughout the plant.

The 10 direct-fired heaters selected to meet these problems are Dravo "Counterflo" units with an output capacity of 2,000,000 Btu per hr each, so arranged as to operate with air taken entirely from the outside. Outside air is drawn into the base of each heater, passed over a stainless steel combustion chamber, and discharged at approximately 2000 fpm either through overhead discharge nozzles or ducts. Each heater handles approximately 22,000 cfm.

Four of the heaters are located outside the building in specially built metal sheds. Discharge ducts extending through the wall from the heaters carry warm air into the foundry to areas where it is needed. Four additional heaters are floor-mounted in the foundry along the interior walls with their intake ducts extending through the adjacent windows. The other two heaters, because of limited floor space, were mounted in a horizontal position on overhead steel platforms.

Heaters No. 1 and 2, in one metal shed at the southeast corner of the foundry, discharge tempered air through ducts to strategic locations across the 120-ft width of the building. Seven melting pots, two smeltering furnaces, one cadmium silver resmelting furnace,



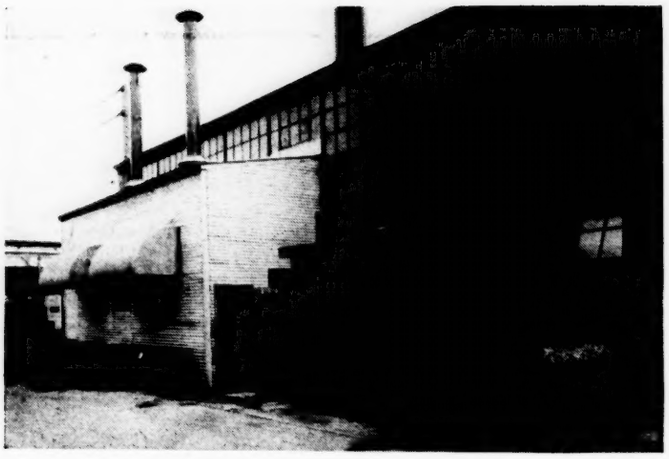
Overhead ducts in babbit foundry area run from heater in outside shed and replace air exhausted through hoods over furnaces and other equipment.

one lead hammer furnace, and five pouring mold stands are situated in this area. Each furnace is equipped with a hood to carry off noxious fumes. Moreover, considerable quantities of air are used for combustion in the furnaces.

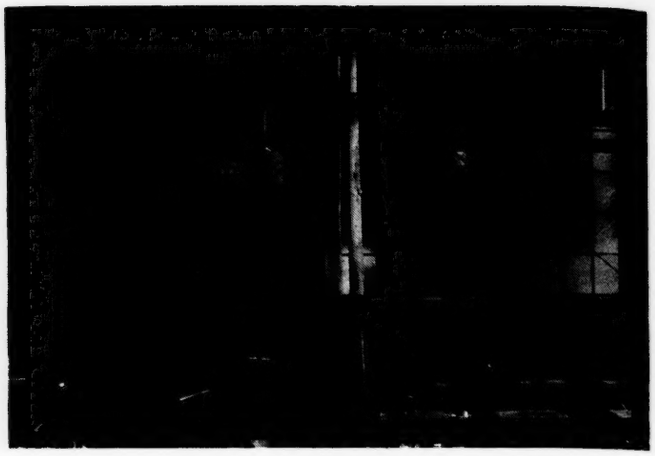
Heater No. 3 is a horizontal unit mounted on a steel platform in the rough grinding and inspection department. The platform is about 12 ft above the floor. There are seven grinders, each connected to exhausters that remove the dust as gate bosses and other pieces are ground off the bronze castings before they are sent to the machine shop.

Heater No. 4 is an upright unit that throws makeup air into the shot-blasting department where three large rotary shot-blast machines are located. No. 5 heater is a platform-mounted horizontal unit along the west wall and supplies makeup air for that part of the molding department running parallel with the west wall. It discharges toward the north end of the building.

Heaters No. 6 and No. 7 are positioned upright on the floor along the east wall in the melting department to replenish the air exhausted through hoods over five large smelting machines, a cupola furnace and two ladle preheaters. Heaters No. 8 and No. 9 are in a metal shed outside the east wall. The entire output of one of these heaters is discharged directly into the core oven area. The discharge from the second is taken



Metal shed attached to foundry building houses two Counterflo heaters. Two hoods admit outside air to heaters. Warmed air is introduced to foundry as shown at right.



Two heaters in shed at left are vented into foundry as shown above. One heater opens directly into core oven area. The other is directed to the shakeout department.

by ducts to the sand molding and shakeout department where exhaust hoods cover extensive areas to remove smoke, heat and fumes.

Heater No. 10 is placed in the northwest corner of the building, discharging into an area occupied by five hooded melting pots, one smelter, several die-casting stands and two enclosed skimming stations.

To coincide with the existing piping systems in Federal Mogul's foundry, thereby minimizing the amount of alteration required, five of the units are arranged for firing either with fuel oil or gas. All of the heaters have special automatic modulating controls to keep the temperature of makeup air constant and uniform. The burner in each heater is regulated by a ductstat so the discharge air will be approximately 85F, regardless of outdoor temperature. This brings within reasonable limits the demand on the overhead steam unit heaters used for space heating throughout the plant. In the summer, the burners in the Dravo equipment are shut off and the heater fans bring in unheated outside air for ventilation.

Approximately 20,000,000 Btu per hr are required to raise the temperature of 220,000 cfm of air from zero to 85F. Handling such a volume during zero weather would require approximately 600 boiler horsepower.

Bringing outside air into the foundry in this manner increases the efficiency of exhaust equipment because atmospheric pressure in the structure remains equalized. Exhausting lead fumes, for example, is difficult in negative pressure because these fumes are heavier than air, and suction fans working without a positive replacement air supply would pull out more air than fumes.

Vista-Dome Streamliner in Service

Modern air conditioning and refrigeration equipment is playing a vital role in the passenger comfort picture aboard America's first regularly scheduled Vista-Dome transcontinental California Zephyr streamliner, recently put into service between Chicago and San Francisco by the Burlington, Denver & Rio Grande and Western Pacific railroads.

Six complete California Zephyr trains are included in the new $12 million fleet providing daily service between the midwest and the Pacific Coast. Built by the Budd Company of Philadelphia and air conditioned and refrigerated by Frigidaire Division of General Motors, each train consists of a Diesel-Electric locomotive, full-length baggage car, three Vista-Dome coaches, a buffet-lounge car with Vista-Dome, a 16-section sleeping car, a 48-passenger diner, three all-room sleeping cars and a lounge-observation car, also equipped with a Vista-Dome compartment. The design of the new Vista-Dome cars is similar to that of the General Motors "Train of Tomorrow."

Each separate car making up the new fleet is equipped with its own individual air conditioning system. However, unlike the "Train of Tomorrow" which is equipped with individual Diesel generating systems, Zephyr refrigerating units are powered by axle-driven electrical generating equipment. Although the load varies in each, a 12-horsepower compressor-motor unit and full-flooded type evaporative condenser is standard on all cars.

The compressor-motor unit, especially designed for railroad application, is mounted under the car in a position convenient for servicing and maintenance. All motor controls are grouped on a single panel, which is located in a convenient locker in the car. The full-flooded evaporative condenser is equipped with large spray nozzles which deliver water over coils for heat removal. The reduction in operating pressure results in maximum efficiency. The water, with the exception of a small amount lost through evaporation, is circulated through the spray system over and over again.

Modulated cooling is provided by dividing certain cooling units into two sections, each with its own expansion valve and distribution header. When reduced cooling is required, an electrically controlled valve shuts off the flow of refrigerant to the upper section of the unit.

It's Time to Service Your Cooling System

K. E. SONTAG
Service Manager, The Trane Co., La Crosse, Wis.

Practical suggestions for getting summer cooling systems ready for the warm days ahead. Here are the things to check and correct that trouble-free operation may be assured.

THE first robin has been seen as far north as Sault Sainte Marie and anglers are already wetting their lines. Spring is here—can summer be far behind?

These signs are just as good as a calendar to remind building owners, engineers and service men that it is time to get that summer cooling system in order for the hot days ahead. There are a number of important points to check, if headaches are to be avoided in the months to come. They are standard checks. There are no short cuts to a good service job of this nature. Yet, there are suggestions that will make the complete job easier and assure excellent service to the equipment operator.

Although seasonal servicing of mechanical refrigeration equipment is the main topic of this article, a suggestion or two are included on desirable checks prior to placing a well-water cooling system into operation. Because all air conditioning systems are practically "tailor-made," it is impossible to give explicit instructions which will be applicable to every installation. Therefore, while the points listed are general points, they are important whether they require the adjustment of 20 valves or one valve to make the system operate properly.

(1) Check coils in the cooling system. Plugs may have been removed and system drained for winter. Replace plugs and close valves to the coils. Be certain that all valves to coils are closed before cracking the main water supply valve to allow gradual filling of system. If coils are located in several equipment rooms on different floors, start at the bottom of the system venting coils in each equipment room from first floor to top of system.

(2) If a deep well pump is part of the system, it should be checked for proper lubrication and electrical connections. After all valves are open, trip pump switch for momentary operation of pump. Do this two or three times. If operation is normal, throw switch for regular operation.

(3) After the system has operated for two days, recheck coils for air binding.

The procedure for preparing air handling equipment for operation is the same whether the system uses water or mechanical refrigeration as the source of cooling. Here again there are a number of important steps in setting the system in operation.

(1) Check the motors for proper lubrication and electrical connections.

(2) Check the fan, bearings and belts to see that they are in operating condition.

(3) Do not forget the filters. While checking the filters for cleanliness also check the surface of the coil to see that it is clean. One building owner had his serviceman start up the system after a check, but he got no cooling—in fact, he got no air distribution at all. The filters were clogged with dust and dirt to such an extent that air could not be drawn into the system.

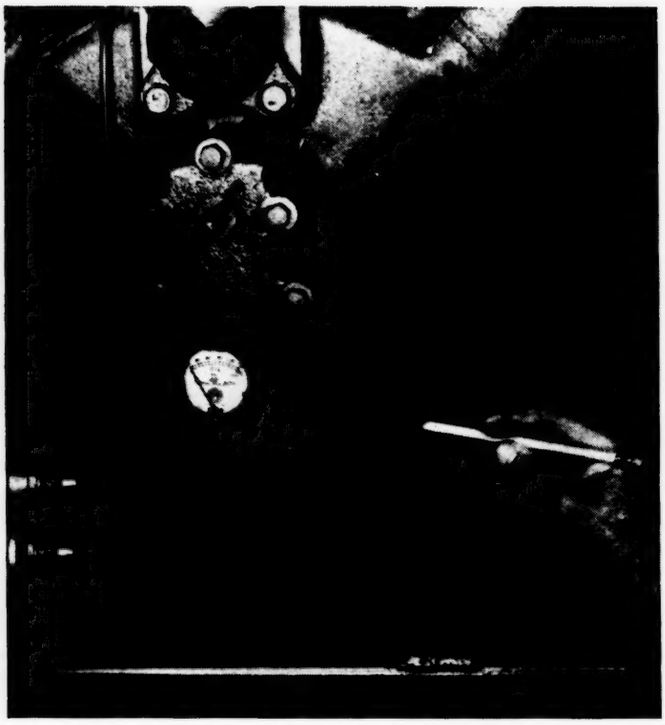
If it is possible to manually operate the air handling equipment on the spot, check it for noise and general operating characteristics.

Before proceeding further, check the oil pressure in the crankcase of the compressor. The normal operation of shutting down a refrigeration plant for the season is to leave 2 lb pressure in the system. Now, before opening any valves, observe this pressure to determine if there was a loss of pressure during the shutdown period. A lower pressure indicates a leak in the system. Remember that both Freon and oil will escape through the defective part. How to search out these leaks is described later.

Checking the Evaporative Condenser

If there is an evaporative condenser in the system, it should be next on the check list. In a good many in-

Test gages are installed in back seat ports of suction and discharge shut off valves.



Oil level should stand at the middle of the sight glass as indicated.

stallations, the evaporative condenser is mounted on the roof. The service suggestions here are simple to accomplish, provided the unit was serviced properly when the system was shut down at the end of the season the previous fall.

(1) Here again motors, fans and belts are first on the list for checking and servicing. V-belts should be free from wear and have a live feeling when struck with the hand. They should not be "fiddle-string" tight.

(2) For outdoor installations, the next step is to clean out the sump. If there is water in the sump, start looking for trouble. This, very possibly, indicates the unit was not properly drained and lines in the system may have frozen and ruptured. Before going ahead with the check-up, inspect the piping that is exposed to the elements or where freeze-up may occur.

(3) Close the drain on the sump.

(4) Open the water supply valve to the unit and at the same time check the operation of the float valve in the sump.

(5) Check the operation and for leaks in pump. First, turn the pump over by hand to check freedom of operation. Then with the pump operating electrically, check for leaks. There should be a slight leak at the packing for the pump to be operating at its best. This leak should amount to a rather infrequent drip and not a steady flow from the packing.

(6) Examine the coil for corrosion or fouling. If the coil is fouled with scale, it should be cleaned with an inhibited acid. After using the inhibited acid, the coils should be well flushed with clear water to remove the cleaner.

(7) If the liquid receiver is mounted near the evaporative condenser, now is the time to open both valves in the liquid receiver.

On some installations, there is a shut off valve in the hot gas line on the evaporative condenser. This valve should be opened as the last step in getting this unit ready for operation.

If the system uses a shell and tube condenser instead of an evaporative condenser, there are two inspections to make. (1) Open the valve for the water supply to the condenser. (2) Use a screw driver to momentarily open the water regulating valve on the condenser. This will flush the valve mechanism and put it in readiness for operation.

Refrigeration Unit

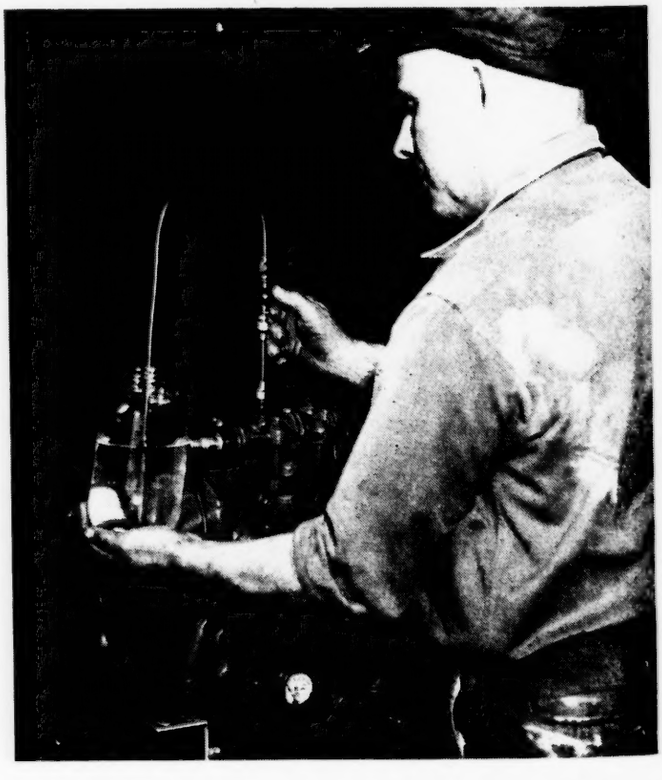
All parts of the system are important, but the refrigeration unit is the most vital. Every precaution and check must be made to certify the correct operation of this unit.

(1) First of all, make the usual inspections for proper motor lubrication, electrical connections and condition of belts, if belt-driven. If direct-driven, inspect the coupling for signs of wear.

(2) Open all valves on the unit. These include the liquid valve, suction valve, and hot gas discharge valve. It's a good idea to double check this operation. Things can happen very fast if one or more valves remain shut during operation of the compressor.

(3) Check electrical connections to the compressor. The main fuse disconnect switch has probably been locked in the open position to guarantee non-operation of the unit during the seasonal shut-down. This should be unlocked and closed at this time.

(4) Next, throw compressor switch in and out two or three times. Allow compressor to run a few seconds each time the switch is thrown in to get oil on the



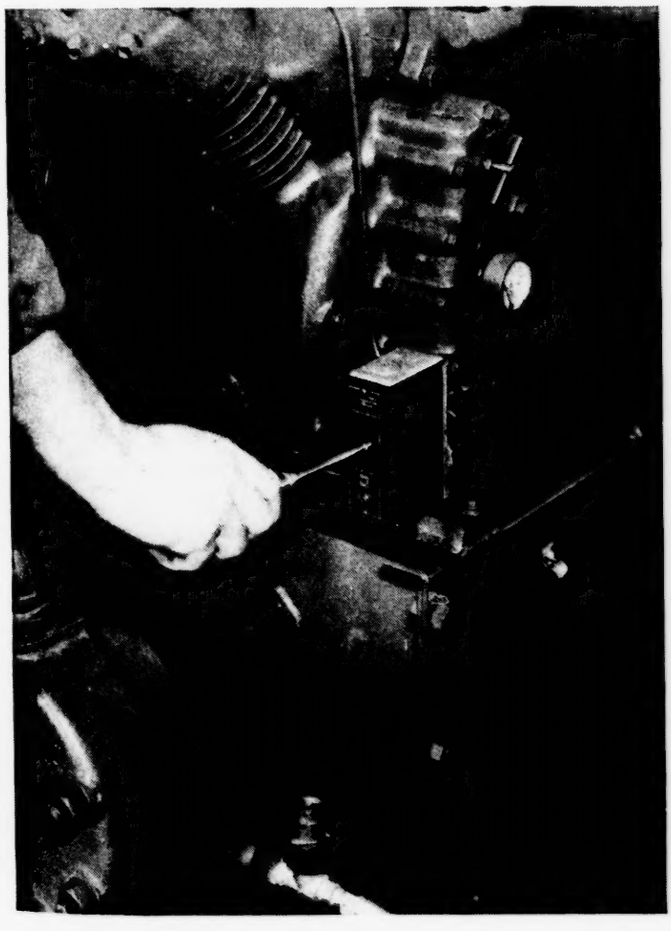
Adding oil through the back seat port of the suction shut off valve.

seal. This short periodic operation also helps to separate the Freon from the oil.

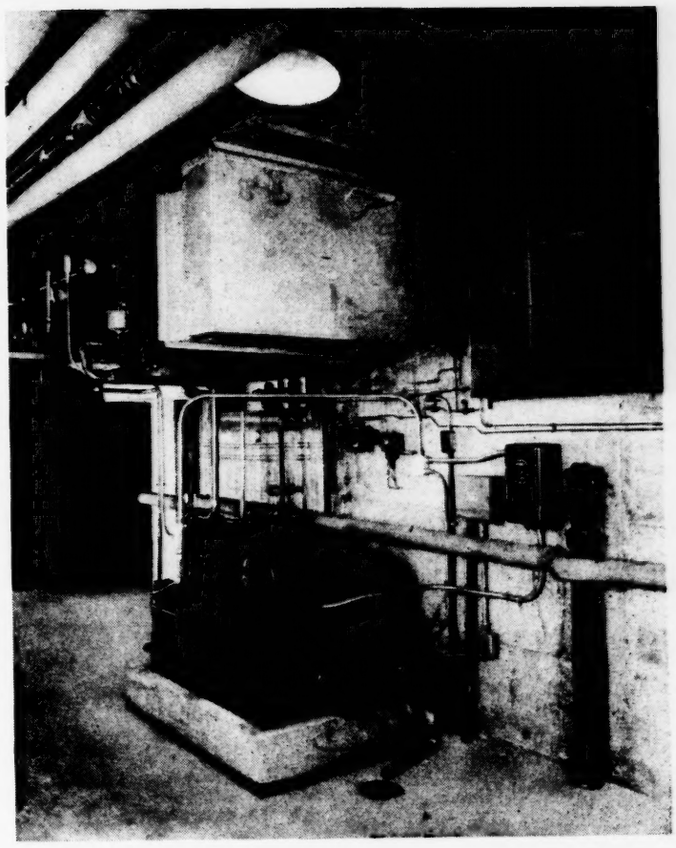
(5) Put the system into operation. This includes starting up the air handling equipment, evaporative condenser (if included in the system) and compressor. If there is a gage on the crankcase, observe the oil pressure. It should be above the pressure in the suction line. Observe the oil in the crankcase. If low, one of two things has happened. Oil may have mixed with the Freon and be held in another part of the system, or oil has escaped through a Freon leak. To determine which of these malfunctions has occurred, run the compressor intermittently for several seconds to try and separate the oil and Freon. If, after several tries, the oil level still remains low, there may be leaks in the system. Check Freon charge through the sight glass on the liquid line. If it bubbles while the compressor is in operation, the charge is short. This is another signal that troubles are present.

(6) Shut down the system and close valves. Leaks may be discovered in two different manners. A halide torch may be used for this purpose. Escaping Freon will turn the color of the torch flame for it is extremely sensitive to the presence of Freon. The other method is to examine the piping system for oil droplets hanging to the underside of the piping. While the Freon escapes into the air, the oil usually clings to the piping in the vicinity of the leak.

There is another possibility, in case the leak cannot be discovered. A previous leak may have been repaired, Freon added, but the oil forgotten. To correct this requires only the addition of compressor oil.



Serviceman checks the operation of the compressor by operating it intermittently through the dual pressure controller.



Location of compressor and air handling equipment simplifies seasonal servicing. System serves operating rooms in a children's hospital.

When the system is in shape again, add the necessary refrigerant and oil. Always remember to add both Freon and oil. When there is a leak in the system, both the lubricating oil and the refrigeration charge will escape.

Compressor Now Ready

A few final inspections remain before placing the unit in operation for the summer. You are now ready to start the air handling unit and the compressor. Run the compressor for approximately 30 minutes. At the end of this time observe the oil in the crankcase and check the condition of the Freon in the sight glass. If everything appears correct, continue to run the equipment while checking the entering and leaving air in the air handling unit. If these temperatures are in accordance with design conditions, check the operation of the controls and upon completion of this step, the air conditioning system should be in tip-top shape for summer-long operation.

It is important that this "spring tune-up" be carried out as fully as possible. The investment in the air conditioning system is well worth the few hours required to set it in top condition for its job during the hot days ahead. While these suggestions are necessarily general, they cover the majority of installations and their form should lend them to easy modification to fit your particular installation.

Air Conditioning Design Conditions for Various Industries

NATHAN N. WOLPERT
Associate Editor, Heating and Ventilating

Compilation of design conditions considered satisfactory for air conditioned rooms in industry. Data are presented on air control for key processes in many industrial applications. Part 1.

CONTROL of air conditions is exceedingly important in a large number of industries to speed production, maintain quality, and to preserve materials and products in storage. Regulation of air conditions has made possible among other things:

(1) Manufacturing processes that previously were difficult to achieve
(2) Precision in machining and in assembling parts
(3) Reduction of damage caused by perspiration and moisture
(4) Preservation of unprocessed and processed materials
(5) Promotion and control of bacteriological processes.

Each industrial air conditioning application is predicated upon special needs to be met for the type product being produced. However, often within one industry there does not appear to be uniformity of thought as to the most suitable air conditions to be maintained. Therefore, considerable research was necessary to obtain air conditioning design conditions for various phases of manufacturing—answers to such questions as the favored air temperature and percent relative humidity to be maintained; influence of dust control; whether bacteriological control was necessary for the respective room or manufacturing area. The information has been grouped as to industrial application, and where there is a difference of opinion regarding the best design conditions, the different sets of data are presented.

Baking

Steam is delivered to bread ovens at 5 to 15 lb pressure. The air conditioning equipment installed not only filters but washes the air and this holds down the dust particles carrying mold spores. In some plants, cakes are passed under ultra-violet rays to sterilize the baking product from mold spores before wrapping. Table 1 presents temperatures and humidities used in various stages of baking and the storage of supplies.

Brewing

While the variables of physical location, equipment, raw materials and processes all affect the conditions in any one brewery, average figures for steps in brewing are given in Table 2.

Wort is cooled after removal from kettle in the coolship and open cooler room. Here the air may be heated to between 90-110F to reduce the relative humidity to promote evaporative cooling. Air to the fermenting cellar must be filtered if fermentation is carried on in open tanks. Filtered air is also supplied to the room for storing liquid yeast and to the coolship and open cooler room. It is not required for the other processes.

The following representative data on air conditions in various departments of a brewery were supplied by

TABLE 1—AIR CONDITIONS FOR BAKERIES

Room or Process	Temperature, F	Relative Humidity, %
Storage		
Flour	70 - 75	65
Yeast	40 - 45	60
Milk and sugar	45 - 55	60
Shortening	50 - 55	60
Canned goods	40	60
Fresh fruits	35	60
Eggs	35	50
Waxed paper	50 - 60	
Ingredient water	34 - 38	
Bread dough in mixers	78 - 80	
Fermentation room	78 - 82	75
Make-up room	82 - 84	65
Proof box	95 - 98	80 - 85
Bread cooling	80 - 85	75
Bread wrapping	65	65
Cake mixing	70 - 75	
Cake mixing—sponge type	95 - 110	
Bread ovens	375 - 450	
Cake ovens	300 - 430	

TABLE 2—AIR CONDITIONS FOR BREWING

Room or Process	Temperature, F	Relative Humidity, %
Fermenting cellar		
Lager	40 - 45	75 min.*
Ale	55	75 min.*
Storage cellar		
Beer or ale	32 - 35	75 min.†
Racking cellar		
Keg filling and storage	32 - 35	75 min.
Hop storage	30 - 32	55 - 62 70 max.
Liquid yeast storage	32 - 34	
Grain storage—When storing for considerable period	80 or less	60 or less

*If wooden tankage is used, relative humidity must be 75% min.; otherwise humidity is maintained to prevent condensation on walls and ceilings.
†If wooden tankage is used.

another authority. For fermenting cellars, temperature should be 38-50F and the relative humidity, 60-85%; bacteriological control is desirable. For storage and finishing cellars, temperature should be 30-34F and relative humidity 60-85%; bacteriological control is desirable for rooms with open tanks. While of less importance in rooms with closed tanks, it is still favored as a means of controlling mold growths on ceilings and walls. Low humidity and dust control are important where malt and other grains are ground and where materials are handled.

Candy

Data on conditions maintained in confectionery plants are given in Tables 3 and 4—each based on data from a different source.

Dust control is employed for handling starch. Ventilation systems are installed to remove heat and vapor from many of the candy furnaces. The use of bacteriological control is increasing and some candy companies employ outside firms that specialize in such sanitation.

While Table 4 and information in the following paragraphs may vary with the preceding data, a study of the combined figures may help to arrive at suitable air conditioning design conditions.

This second candy authority states that jellies and gums are cast into starch molds and are dried in air conditioned hot rooms maintained at 120-140F. While humidity is important (13-19% R.H. for temperatures given) close control is not necessarily needed, since a large amount of personal experience governs the drying procedure.

Cooling tunnels are employed in the cooling of cast chocolate bars, coated centers, and hard candy. Basically, this tunnel is a long insulated box placed around a conveyor in such a manner that the product travels through it. Cold air is supplied at the end of the tunnel at which the product leaves so as to utilize the counterflow principle for the cold air. In general, air is supplied at velocities up to 1,500 fpm and at temperatures of 35-45F. The high air velocity creates a turbulent condition in the tunnel to promote better cooling. In chocolate enrobing, the aim is to secure an even chocolate with some luster. Since the best luster is obtained with rather slow cooling, a slow production rate must be followed or excessively long cooling tunnels used.

Recommended design conditions for the various air cooled rooms follow:

TABLE 3—AIR CONDITIONS FOR CANDY MANUFACTURE
Prescribed by Source A

Room or Process	Temperature, F	Relative Humidity, %
Chewing gum		
Manufacture	77	33
Rolling	68	63
Stripping	72	53
Breaking	74	47
Wrapping	74	58
Hard candy		
After drops are formed	60	40 - 60
Cooling, mixing, packing	75 - 80	40 - 45
Chocolate		
Candy centers for coating	75 - 80	
Hand dipping	63	45
Packing	68	45
Finished cholocate storage	55	50
Nougat, fudge, caramel, toffee		
Panned specialty rooms	70 - 75	45
General candy storage	65	45
Nut storage	50 - 55	50

TABLE 4—AIR CONDITIONS FOR CANDY MANUFACTURE
Prescribed by Source B

Room or Process	Temperature, F	Relative Humidity, %
Hand dipping	60 - 65	50 - 55
Enrober room	75	60
Jellies and gums—drying	120 - 140	13 - 19
Cooling tunnel	35 - 45	
Packing		
Chocolate	65	55
Hard candy	70 - 75	35 - 45
Storage		
Finished candy	70	40 - 50
Nuts	30 - 32	75 - 80

Although most finished goods will keep at conditions shown in Table 4, special attention must be given to nuts so that excessive dehydration of the nuts is avoided, mold growth is retarded, and insect eggs are kept dormant.

Starch or sugar dust is normally picked up by the return air of the cooling cycle and accumulates with condensed moisture on the cooling coils. This reduces the cooling capacity of the coil and provides a maintenance problem. Therefore, the use of filters is recommended for both outside and return air.

Distilling

In the aging of whiskey in warehouses, the whiskey is stored in 50-gal charred oak barrels, in rooms with temperatures between 65-72F and 50-60% R.H. Fermentation is carried on in enclosed tanks; heat generated during this process is carried off and the temperature controlled by heat exchangers.

Dust control is essential in the milling department where grain is received, ground and processed. Two methods are generally employed—the use of a fan to discharge the dust to filters; use of cyclone dust collectors.

Bacterial control is essential although the industry is converting to enclosed fermenters.

Egg Incubation

According to one well versed in poultry husbandry, most of the large forced draft incubators for incubation of chicken, duck and turkey eggs operate at a temperature of 99.5-100F and a relative humidity of 54-56%. At hatching time, the temperature is usually dropped one-half a degree or a little better, and the humidity is allowed to rise.

Fumigation is used about two to three times during the last two days of incubation—that is, on the

TABLE 5—AIR CONDITIONS FOR POULTRY INCUBATION

Room or Process	Temperature, F	Relative Humidity, %
Incubator room	70 - 75	30 - 60
Brooder house		
1st week turkeys and chickens	70 - 75	60
After 1st week	50 - 60	60
Battery rooms		
Starting chicks or turkeys	70	70 - 75
Growing chicks or turkeys	50 - 60	50 - 60
Egg storage rooms	45 - 60	70 and up

twentieth and twenty-first days. A mixture of formaldehyde and potassium permanganate is used to control pullorum disease and omphalitis or navel ill.

Table 5 was drawn from data supplied by another poultry specialist.

No mention was made of air conditions in laying quarters because such conditions vary with the seasons. In summer months, it is desirable to have a maximum of ventilation, regardless of temperature; in winter, to avoid condensation on the interior walls, an attempt is made to hold the temperature to 10F over or below the outside temperature. This procedure applies to houses which do not have forced ventilation systems.

Both dust control and bacteriological control are essential. It is common practice to hose down the floor occasionally in the incubator room to eliminate dust and to prevent the down from incubators and new chicks from floating about the room. Less extreme methods are employed in other rooms for holding down dust.

Fur Storage

Members of the Certified Cold Fur Storage Association have reached the conclusion that the very best method of storing furs in a vault is to maintain temperature at 40F or lower, and the relative humidity from 50-65%. In fact, the American Institute of Refrigeration will not certify a vault as being a cold storage vault unless it can maintain a temperature of 40F in the vault.

Many members of this association store furs just below freezing, chiefly because they store in a wholesale way for many retail stores. Since the price for storage is based on the quantity of furs stored, it is not economical for the storer to inspect the fur. The below-freezing temperature is depended on to prevent any moth eggs or larvae, with which the fur may be infested, from hatching or becoming active.

A shock system for eradication of any insert infestations is also used. This treatment consists of dropping the temperature to 18 or 20F, then raising it to 60 or 70F before the temperature is lowered to 40F, which is the holding temperature. While in the north only one shock treatment is given during a storage season, southern fur storers may employ this system once or twice a season.

In general, fur storers who store their own customers' furs make individual inspection of the furs to determine if they are infested. If they are, then fumigation or cleaning may be employed before the garments are stored at temperatures of 40F or less without the bother of lowering and raising temperatures.

Experiments have indicated that when furs are stored at 40F or lower, as compared with higher vault temperatures, the furs remain pliable, oxidation is reduced, and luster and color are preserved.

Laundry and Dry Cleaning

In laundry work, the problem is to make conditions as comfortable for the workers as possible. The most important phase of the laundry industry is dry cleaning which is conducted under conditions of 65-70F and 65% R.H. At present, there is a tendency to filter the air supplied to the drying rooms instead of the air supplied to drying tumblers. Bacterial control is not considered necessary. In rooms used for drying, after rugs have been washed, air is maintained at 175-180F and 35-40% R.H.

(To be continued)

Bogota has Modern Windowless Building

Housed in a new $1,000,000 windowless, completely air conditioned structure, the Valdiri department store in Bogota, Columbia, now occupies one of the most modern store buildings in South America, according to the Carrier Corporation, which supplied the air conditioning equipment.

Comfort air conditioning is unusual in Bogota, which is situated 9,000 ft above sea level, and is generally cool in summer. Its use resulted from the determination of the store's owner to incorporate in his new building every modern facility available for store operation. The Carrier air conditioning system not only provides comfort for customers, but filters dust from the air, thus keeping displays fresh and clean. It also provides heating and ventilation in the building during winter.

While the building has four large product display windows on the street side, the largest in the city, there are no windows of the conventional type for the admission of light and air.

Radiant Panel Heating:

Influence of Embedment on Uniformity of Panel Surface-Temperature

D. L. MILLS,* L. J. LATART,* and F. W. HUTCHINSON**

IN evaluating the performance of any type of panel heating system a primary requirement is accurate determination of the mean surface temperature of the panel. Many factors lead to variation with respect to position of the surface temperature; the intent of this paper is to present experimental data showing the influence of one particular factor—depth of embedment of copper tube in concrete floor-type panels.

The importance of accurately fixing the surface temperature of the panel is very much greater than is commonly recognized. Thus, if a floor panel were designed for operation at 85F with equivalent room conditions corresponding to 70F air and 70F mean radiant temperature the equation giving the rating of the panel would be,

$$q = hA(t_p - t_a) = hA(85 - 70) = 15hA \quad (1)$$

and a 1F error in determining the panel temperature would therefore be responsible for a 1/15 or 6.7% error in panel rating.

Among the factors which require consideration when evaluating panel surface temperature are the following:

(1) Variation of actual surface temperature from area-to-area across the panel due to change in the mean temperature of the hot water flowing through the tubes. Customary design procedure is to establish a flow rate which will give a mean water temperature drop of from 10F to 30F. The importance of this effect increases, of course, with the design temperature drop, but even for the minimum 10F value it can be readily shown to be of considerable influence. Thus for a sinuous coil panel consider that water is to be supplied at 105F and to leave at 95F. The energy dissipation rate of the panel would be expected to vary with the temperature drop from water to room[1], hence the expected difference between maximum and minimum ratings for this case would be (based on a 70F equivalent room temperature),

$$\text{Maximum rating: } q = UA(105 - 70) = 35UA \quad (2)$$
$$\text{Minimum rating: } q = UA(95 - 70) = 25UA \quad (3)$$

The mean rating is obviously 30UA and the plus or minus departure from this value is $5/30 = 16.7\%$.

(2 Aside from area-to-area differences there will also be local variations due to non-uniform diffusion of heat from the embedded tubes to the floor surface. Variations of this type are attributable to differences in tube diameter, tube spacing and to depth of embedment. Tube diameter has been shown experimentally[2] to be of negligible influence. This result is not unexpected since a heating tube approaches, in effect, a line heat source and has circular isothermals in the region immediately adjacent to the tube. Hence, an increase in diameter (so long as the tube is fully embedded) merely serves to move out the isothermal that would otherwise exist at the tube surface. Since, for given spacing and depth, the panel rating does not appreciably change with change in tube diameter, it follows that variations in surface temperature of the panel are likewise practically unaffected by the size of tube within the usual limits of conventional design.

(3) The influence of tube spacing on uniformity of surface temperature is in need of experimental investigation. The results reported in this paper are all for a fixed spacing of 9 inches, hence can be conservatively extrapolated to 4-inch or 6-inch spacings, but would be unconservative if applied to a system in which the tube spacing was anything greater than 9 inches. Except in unusual cases it is doubtful if spacings much in excess of 9 inches should be used unless conditions of the particular installations are such that the embedment depth will be greater than 2 inches. For embedments up to 2 inches and for spacings up to 9 inches the authors believe that the results given here can be used for all other spacings and embedments with comparative safety.

[2]Loc. cit.

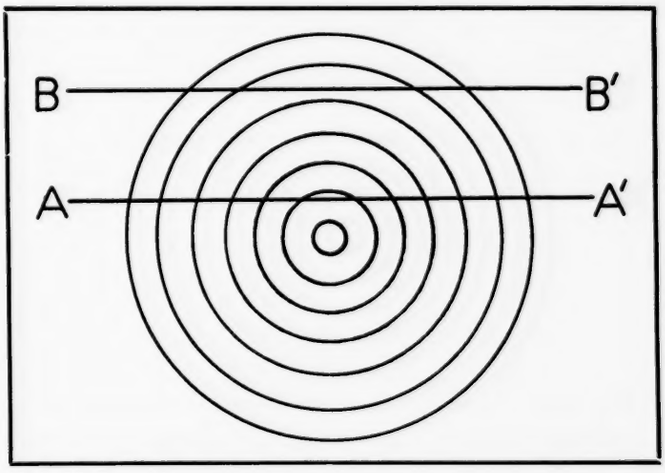


Fig. 1. Isothermals around a line source in an infinite solid. The temperature variation is greater in plane AA' than in plane BB'.

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**Professor of Mechanical Engineering, University of California, Berkeley.

[1]B. F. Raber and F. W. Hutchinson, Experimental Studies on Panel Heating Tube Spacing, ASHVE Transactions, Vol. 53, 1947.

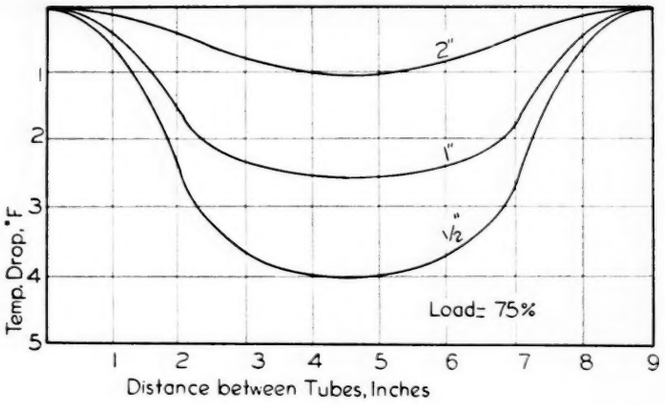

Fig. 2. Surface temperature variation at fixed load for three different depths of bury.

(4) The influence of embedment can be readily visualized by referring to Fig. 1. In this figure it is assumed that a single line source is located in an infinite solid; under this circumstance the isothermals would all be concentric circles and the temperature variation along an imaginary plane AA′ would obviously be greater than along an imaginary plane BB′ which is located farther from the source. In the extreme case of a plane an infinite distance (radially) out from the source there would be no temperature variation whatsoever since the curvature of the isothermal would be infinitesimal and the plane and isothermal would therefore superimpose.

In actual practice the distribution across the surface of a floor panel differs in two major respects from the idealization of Fig. 1. In the first place the plane in question is not located within the mass of the embedding material, but is instead a boundary which marks thermal discontinuity. In many cases the thermal resistance at the panel surface is so great in comparison with the resistance of the embedding material that distribution across the surface is determined to a greater extent by conditions out from the surface rather than by conditions behind it. The second difference arises from the fact that not one but many tubes are embedded in the real panel, hence interference effects are experienced a short distance out from the tube surface with resultant alteration in the shape of the isothermals. The interference effects tend to increase the uniformity of surface temperature, hence are helpful rather than otherwise; analytical investigations of surface temperature frequently start from a study of distribution due to a single tube, then proceed to development of distributions for multiple-tube arrangements by applying the principle of superposition and vectorially combining the components to obtain the resultant group isothermals.

(5) The factors so far discussed influence performance at fixed load for various designs of systems. For a given system variation needs to be investigated as a function of load. Thus, at zero load the panel surface temperature would always be entirely uniform and fixed at 70F. For very light load the mean panel temperature might need be 71F and the maximum point-to-point surface temperature variation would obviously be less than 1F. The same system under conditions of greater load would require a higher mean surface temperature, hence would experience a wider variation in maximum-to-minimum surface temperature. Thus at times of great-load—which, of course, should be the time selected for a rating test—the variation is greatest and the experimental difficulty attendant on evaluation of mean surface temperature is most serious.

Experimental Set-Up

The tests reported in this paper were conducted in the "field laboratory" which has been described in an earlier article[3], thus it is unnecessary here to repeat a description either of the rooms or of the method of instrumentation. It should be emphasized, however, that the three floor panels which were tested are primarily heating units which operate to provide comfort for the occupants. In every sense these units are practical operating panels rather than special laboratory units, though instrumentation is as complete as it would be for precisely-controlled research units.

During the period covered by the tests the panels were under control of the "inhabitants" of the test space, the test engineers serving merely as observers and recorders of the performance of the systems. The three units tested are identical in all respects except that of depth of tube embedment and the data reported were obtained from tests in which the load on all three panels was practically the same (except results shown in Fig. 3 which correspond to selected loads as observed on one particular panel). Temperatures were obtained by means of sets of permanently installed thermocouples which are located just below the surface of the floor; an additional group of exploring thermocouples was used for obtaining surface temperatures at intervals of one inch across the distance separating two adjacent tubes. In each case the data summarized in the curves was checked by two or more duplicating tests under equivalent conditions of load and operation.

Representation of Results

Since control of the panels was vested in the occupants rather than the test engineers it follows that differences in the temperatures maintained within the three different rooms occurred not because of differences in the heating systems, but rather as a result of the idiosyncracies of the occupants. Thus, equivalent room temperature in one case was a few degrees lower than in another, but the difference was due to the personal preference of the people who worked within that room. In order to permit a direct comparison of the three panels and to eliminate such fortuitous effects as varyng air-temperature control-point, the results of the constant load tests have been plotted (refer to Fig. 2) against a temperature scale which shows deviation from maximum, but does not indicate the actual surface temperatures at the respective panels. On this basis the surface-temperature curves for all three panels coincide at the point on the surface which

[3]Instrumentation for Field Tests of Panel Heating, D. L. Mills, L. J. LaTart, and F. W. Hutchinson, HEATING AND VENTILATING, April, 1949

is directly over the tube (point of maximum temperature). A thermally more informative, but less graphic, representation would have been obtained if the three curves had been plotted for the same mean surface temperature; since the loads for the three units were the same during the period of the tests which are reported, it follows that the mean surface temperatures during this period was necessarily the same for all three panels.

Referring to Fig. 2 it is evident that increasing the depth of bury of the tubes has a decided effect—at constant load—on the uniformity of surface temperature. Thus for a depth of ½ inch from surface of panel to top side of tube the variation in temperature across the 9 inches space between tubes is 4F at 75% of design load. Conclusive data relating load with variation were not obtained, but from the limited results shown in Fig. 3 it appears that the surface-temperature variation increases almost as a linear function of load. On this bases the temperature change between tubes buried ½ inch would be 1.33 × 4 = 5 1 3F for operation at design load. Ths is equivalent to a departure of more than 2.6F plus or minus from the mean panel temperature, hence—referring to equation 1—could be responsible for an error of plus or minus 2.6/15 = 17.3%. But it has already been shown that an almost equal (16.7%) error could occur due to the design value of change in mean water temperature. These two errors could be either cumulative or compensating, depending entirely on chance, so that even with precise temperature measurement there is an opportunity for error amounting to plus or minus 17.3 + 16.7 = 34% in experimental evaluation of the temperature difference from the panel surface (for a floor panel) to room environment.

The above conditions apply to wall and ceiling panels as well as to floor installations, but to a lesser extent because of the greater design value of ceiling and wall surface temperatures.

Advantageous though it is to have a uniform surface temperature, the advantage is sometimes offset by the disadvantage accompanying use of deeply embedded coils. The greater the depth of embedment the higher will the mean water temperature have to be and the greater will be the consequent storage of

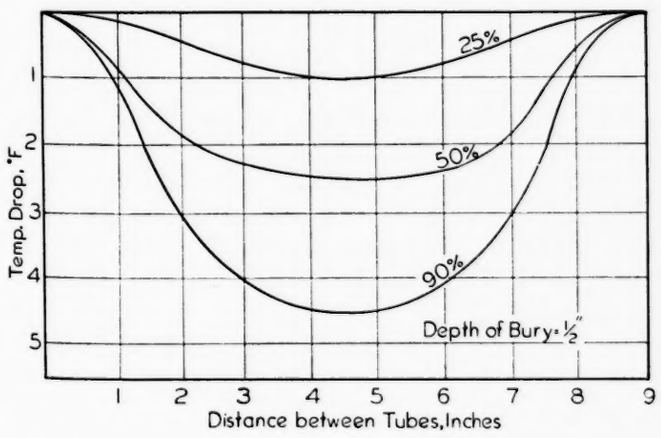

Fig. 3. Variation in surface temperatures for a fixed depth of bury for three different load conditions.

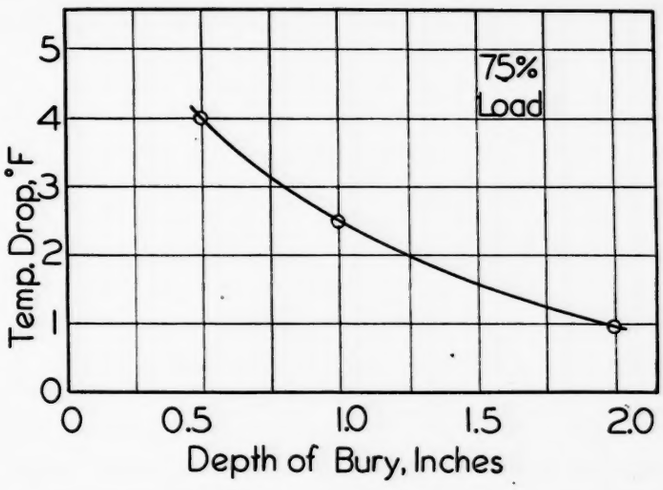

Fig. 4. Maximum variation in surface temperature for one load for various depths of bury.

heat in the slab. Since response of the heating panel to changes in load is approximately inversely proportional to the thermal capacity of the panel (product of specific heat by density) it follows that the difficulty of maintaining control will increase with the depth of embedment.

Fig. 4 shows the three experimental points obtained on the curve of maximum surface variation as a function of depth of bury. From the apparent slope of the curve it would appear that the range of greatest practical importance is from ½ inch to 2 inches; less than ½ inch would lead to serious surface temperature variation, but this is not of practical significance because practical considerations—with respect to floor loading— always require a minimum of ½ inch bury; for bury greater than 2 inches the curve flattens out, but the storage factor increases rapidly so storage effects become controlling.

Conclusion

For floor-type panel heating systems of average design there is no appreciable influence on effective performance due to variation of the point surface temperature from the mean surface temperature. Variations of this kind occur due to the cooling of the water as it passes through the coils and also due to spacing and depth of tubes, but the differences are of the order of 3 to 10F and are not noted by the occupants.

However, from the standpoint of effective testing of systems and of accurate analysis of load it is extremely important that every experimental effort be made to determine the true *mean* surface temperature. Analysis shows that an experimental error of only 1F will be responsible for a 6.7% error in rating, whereas use of an indiscriminately recorded spot-temperature may lead to an error of the order of 34%.

Experimental evidence has been presented to show the influence of depth on uniformity and limited experimental evidence is presented which suggests that variation of surface temperature is very nearly a lineal function of load (at fixed depth).

Precise Refrigeration Control is Key to Blood Fractionation

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Pitman-Moore Co.,* Zionsville, Ind.

Proteins from human or animal blood plasma are used by the medical profession in treatment of such diseases as measles, diphtheria, tetanus and others less commonly known. Separation of proteins from plasma is accomplished by fractional precipitation under precisely controlled temperature conditions where a change of one or two degrees may affect the yield by as much as 60%. The plasma processing and storage room temperature controls used in the Zionsville, Ind., plant of Pitman-Moore Co., pharmaceutical manufacturers, are described.

THE processing of blood plasma is quite complex, principally because of the large number of chemical substances present and the difficulty of their separation. By carefully controlling temperature, pH, salt content, and other chemical and physical variables, some of the blood proteins can be separated by precipitation. That is, by adding a substance or substances to the plasma and establishing a given set of closely controlled conditions, one or more components may be rendered insoluble. The material then is centrifuged at very high speeds to separate the insoluble substance or precipitate from the rest of the liquid. This process may have to be repeated several times to obtain the desired protein fraction. Such a series of operations is known as fractional precipitation.

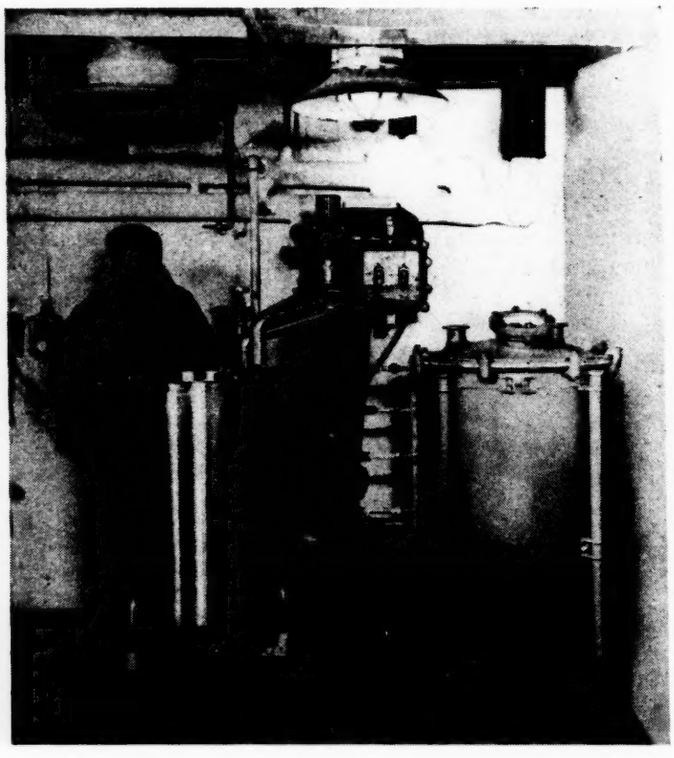


Fig. 1. Refrigerated room where blood proteins are processed. Note uninsulated centrifuge in center.

Temperature Determines Yield

Precipitation operations are carried out in stainless steel or glass-lined vessels under precisely controlled temperatures. As illustrated in Fig. 1, these vessels are located in large refrigerated processing rooms since in most cases it has been found easier and more effective to establish and maintain the processing temperature conditions in this manner than to resort to individually refrigerated vessels. In general, precipitation occurs slowly, requiring several hours. A change of but one or two degrees Centigrade during the precipitation operation, or during centrifuging which follows, can mean the difference between a satisfactory yield of 80% or more to a yield of only 20% or less. A wider temperature variation can result in complete loss and, when a substance as precious and costly as human blood is involved, such losses cannot be tolerated.

Dual Cooling Systems

The processing room is cooled by recirculating air discharged from the room over refrigerated cooling coils. Since processing temperatures are in the range of 32F to —4F, refrigeration is required on a 24-hour basis all year long. This refrigeration is provided by an eight-ton Frick ammonia system. The entire installation which is replete with signals and interlocking safety controls was designed and engineered by by Hayes Bros., Indianapolis.

In this installation, two full-capacity cooling units alternately share the process load. By alternate operation of the units, the defrosting of the coils is simplified, and the wear and maintenance of the equipment are equally divided, providing greater long-term insurance against breakdown.

Heart of Control System

The process-room temperature is measured by a nickel wound resistance thermometer bulb located at a point most representative of the process space temperature. This bulb is connected to an indicating-

*Division of Allied Laboratories, Inc., Indianapolis, Ind.

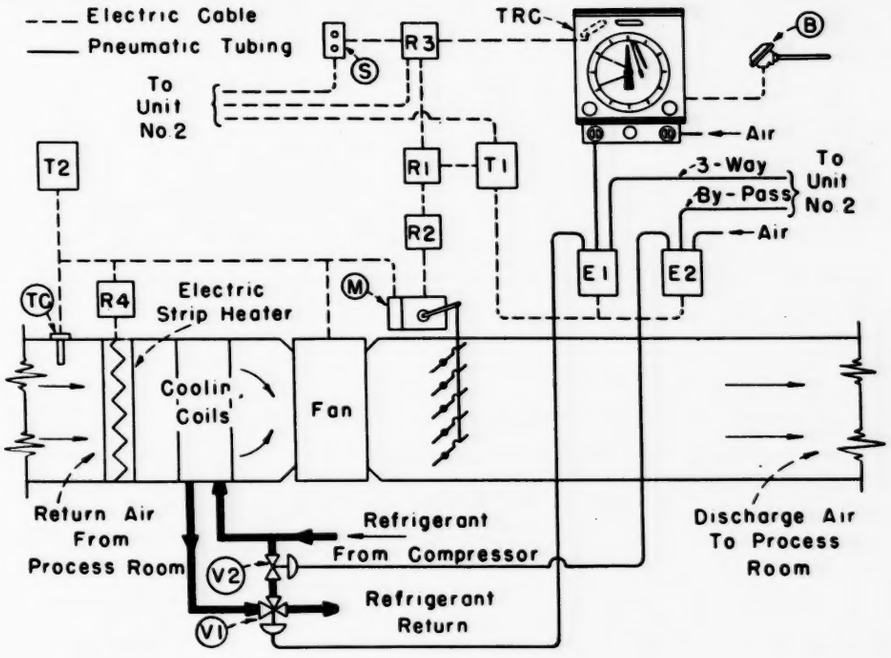


Fig. 2. Refrigerating control system for process rooms. Legend: TRC, recording ElectroniK resistance thermometer with auxiliary switch; B, resistance bulb located in process room; E1 and E2, electric-pneumatic relays; M, two position Modutrol motor with auxiliary switch; R1, R2, and R3, electric relays; R4, load relay; S, signal light and reset button station; T1, master timer for six-hour cycle; T2, timer for defrosting; TC, high limit control; V1 and V2, diaphragm motor valves.

recording electronic instrument which is equipped with a pneumatic proportional-reset control unit. The instrument is calibrated from —20C to 0C (—4F to 32F) and incorporates a by-pass panel for convenience in shifting from automatic to manual control and vice versa. This instrument throttles a Gradutrol diaphragm motor-operated three-way mixing valve in the refrigerant supply line to the cooling coils.

Two paths of refrigerant flow are possible through this valve. When in one extreme position, all refrigerant supply will be passed through the cooling coils; in the other extreme position, all refrigerant will be by-passed around the coils. Normally, when the cooling unit is in operation, the mixing valve will assume an intermediate position, permitting just enough refrigerant to pass through the cooling coils to maintain the desired process-room temperature. This valve and all other diaphragm motor valves on this installation are equipped with positioners to assure positive and accurate control action.

A master timer switches the load from one cooling unit to the other at intervals of six hours. Should the process-room temperature rise over one degree above the set point during any given cycle, however, the system will automatically switch over from one unit to the other, thus providing maximum protection to the process. Defrosting of the cooling coils is accomplished automatically.

Operation of the Control System

Some appreciation of the thorough manner in which the cooling control system was engineered so as to maintain constantly a processing temperature accurate within plus or minus ¼ degree, and to provide maximum assurance against the costly consequences of equipment failure and inefficiency, can be gathered from the schematic diagram, Fig. 2. For simplicity, only one cooling unit, designated as No. 1, is shown. The other cooling unit is identical in operation.

The process temperature is measured by resistance bulb *B* which is connected to electronic controller *TRC*. Controlled air pressure from this instrument is connected to Honeywell electric-pneumatic relay *E-1*. Master timer *T-1* initiates switchover from one unit to the other at intervals of six hours. An electric impulse from *T-1* causes relay *E-1* to transfer the controlled air pressure from the three-way mixing valve on one unit to the other similar valve on the second unit. An impulse from *T-1* also causes electric-pneumatic relay *E-2* to reverse the operation of the valves in the refrigerant by-pass lines of each unit.

Assuming that unit No. 1 is carrying the refrigeration load, note that controlled air pressure from *TRC* will pass through *E-1* and will throttle three-way mixing valve *V-1*. The position of this valve determines how much refrigerant reaches the cooling

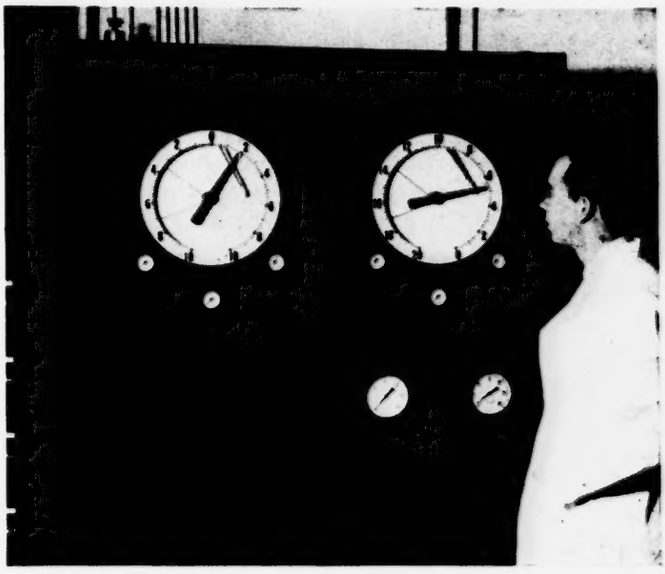


Fig. 3. Panel board including two ElectroniK resistance thermometer pneumatic controllers for (left) storage room and (right) processing room.

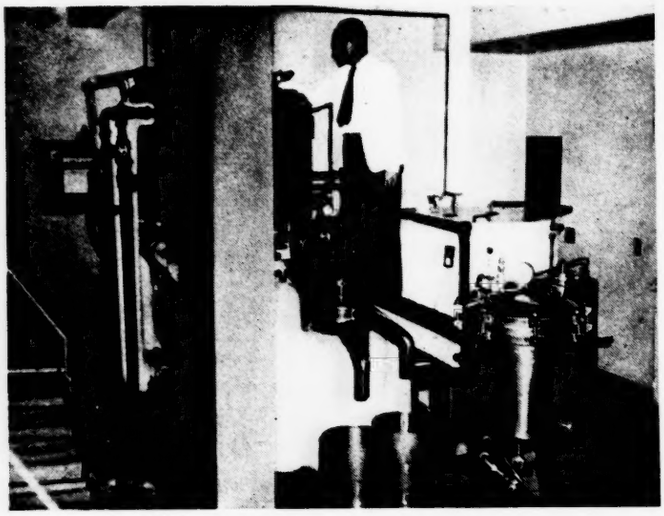


Fig. 4. Temperature controlled centrifuge (center with spouts) for separating biological substances.

coils and how much is by-passed. A slight temperature rise as sensed by bulb *B* will immediately be reflected in a change of controlled air pressure from *TRC*, causing *V-1* to permit more circulation of refrigerant to the coils and less refrigerant to be by-passed. The reverse action occurs on a slight temperature fall. When unit No. 1 is in operation, relay *E-2* permits supply air to reach diaphragm motor valve *V-2*, located in the by-pass line, keeping the valve and consequently the by-pass line open.

When switchover occurs, *E-1* transfers the controlled air pressure from *TRC* to unit No. 2. Air is bled from the diaphragm of *V-1*, causing it to close the port on the return line from the coils. At the same time, *E-2* bleeds air from *V-2*, causing the by-pass line to close. Thus, with both lines closed, all circulation of refrigerant to or around unit No. 1 is stopped. Reverse actions of the valves on unit No. 2 occur, thus putting that unit into full operation. Also, when switchover occurs, *T-1* actuates electric relays *R-1* and *R-2*, causing Modutrol motor *M* to close the dampers on the outlet side of cooling unit No. 1 and to shut off the fan of this unit. *T-1* simultaneously actuates similar relays on unit No. 2 to cause the dampers of that unit to open and the fan to start.

Defrosting Controls

Defrosting of the cooling coils is accomplished automatically when a unit is switched off the load. On unit No. 1, timer *T-2* determines the length of time during which there will be application of power to the electric strip heater located adjacent to the cooling coil. This timer is adjustable from 2 to 50 minutes and its setting will be determined by the moisture content of the recirculated air. An auxiliary switch in motor *M* energizes *T-2* when the dampers of unit No. 1 are fully closed. A high limit temperature controller *TC*, adjustable from 104F to 221F, acting through load relay *R-4* will automatically cut off power to the strip heater should it exceed the predetermined high limit set point, thus providing protection to the cooling coils.

Emergency Switchover Controls

For maximum protection against exigencies of operation, the electronic controller *TRC* is equipped with a mercury switch which is actuated instantly should the process temperature rise to the extent of one degree above the set point. Contact by the mercury switch energizes electric relay *R-3*, causing signal light *S* to give visible warning. Energizing of *R-3* also causes immediate switchover from one cooling unit to the other. This emergency switchover remains in effect until the process temperature again falls within one degree of the set point and until the push-button is manually depressed. This latter action returns the cooling load to the unit with which difficulty was experienced.

Storage Room Temperature Control

Most products made in the processing room just described must be stored under refrigeration. The control system for the storage room is quite similar to that used for the processing room with exception that the electronic resistance thermometer controller (Fig. 3) is calibrated from —10C to 10C (14F to 50F).

For products where processing temperatures are not quite so critical, the super centrifuges and other vessels are individually refrigerated. One installation of this type is illustrated in Fig. 4. Note in the background the strip chart electronic potentiometer, calibrated from —20C to plus 70C (—4F to 158F) and equipped with a mercury switch for controlling a solenoid valve in the refrigerant line.

Many pharmaceutical manufacturing processes would be impossible without the ultimate in temperature control.

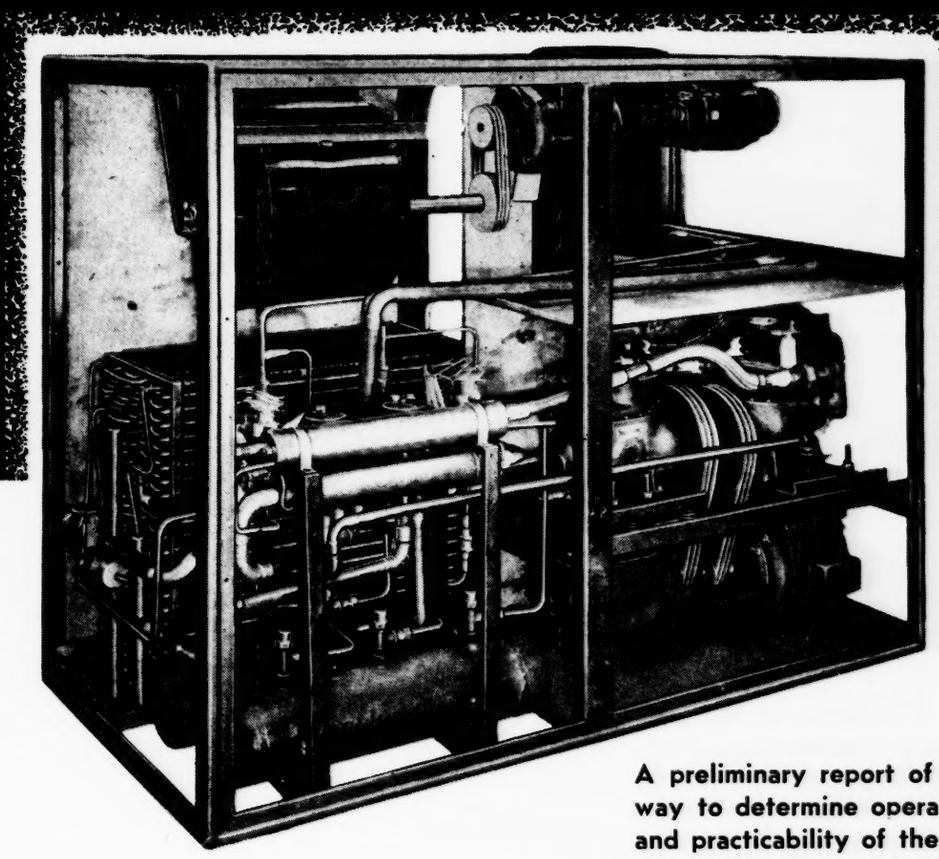
Recommended Revision of Standard for Warm Air Furnaces

A recommended revision of the standard for warm air furnces equipped with vaporizing pot-type oil burners, Commercial Standard CS104-46, has been submitted to manufacturers and other interested groups for consideration and approval, according to the National Bureau of Standards.

This recommended revision was originally proposed by the Federal Housing Administration. It provides for a field test and the posting of an installation certificate, such as are now included under the standard for automatic mechnical-draft oil burners designed for domestic installation, Commercial Standard CS75-42; contains several other adjustments designed to bring the standard abreast of current practice; and has the endorsement of a representative standing committee of the industry. Mimeographed copies may be obtained from the Commodity Standards Division, National Bureau of Standards, Washington 25, D. C.

The Residential Heat Pump in Various Climates for Summer and Winter Air Conditioning

PHILIP SPORN, President
and
E. R. AMBROSE, Air Conditioning Engineer
American Gas and Electric Service Corporation, New York



A 5 hp heat pump with front and sides removed.

A preliminary report of a field study now under way to determine operating characteristics, costs, and practicability of the heat pump. Installations are in five houses in five cities from Roanoke, Virginia, to South Bend, Indiana. This investigation is part of the development program of the American Gas and Electric Company looking toward a modern all-electric home.

A HEATING AND VENTILATING Progress Report

The Residential Heat Pump in Various Climates for Summer and Winter Air Conditioning

PHILIP SPORN, President
and
E. R. AMBROSE, Air Conditioning Engineer
American Gas and Electric Service Corporation, New York.

TO properly evaluate the future possibilities of the residential heat pump system, it is necessary to have some knowledge of what the heat pump is and how it operates. However, of equal if not greater importance are the research and development programs now under way to obtain practical solutions to some of the problems facing this type of system.

The development program described in this article is being sponsored by the American Gas and Electric and its subsidiary companies.

Pilot Installations

The need for additional research and development with the heat pump has been mentioned frequently. A great deal of design, operating and performance data have been obtained and made available on custom-built heat pump systems in commercial establishments and office buildings. This information has greatly assisted the engineer in the design, equipment selection, and installation for similar structures. Unfortunately, very few reliable and useful data of this nature are available on the residential heat pump system.

In order to acquire a better understanding of the various factors facing the residential heat pump and at the same time acquire performance data and its relationship to the other residential electric loads, the American Gas and Electric and subsidiary companies have undertaken, in cooperation with the home owners, their architects, and the York Corporation, an extensive field test program on five pilot model residential heat pump systems.

Location. These five pilot model heat pumps are located in Kingsport, Tenn.; Abingdon, Va.; Roanoke, Va.; Coshocton, Ohio, and South Bend, Ind. The purpose of this scattered distribution is to obtain maximum variation in design requirements and to thoroughly test the units under radically different climatic conditions.

Construction. The five residences in which the heat pump units are located vary considerably in the

TABLE 1. SUMMARY OF DATA ON FIVE PILOT RESIDENTIAL HEAT PUMP INSTALLATIONS

Location	Kingsport, Tenn.	Abingdon, Va.	Roanoke, Va.	Coshocton, Ohio	South Bend, Ind.
No. of stories in house	1½ Story	1 Story	2 Story	1 Story	1 Story
Volume, cu ft	16450	13550	9850	18000	9300
Heat loss, Btu per hr,					
Conduction	29650	28336	24681	47968	38808
Infiltration	10350	8540	6200	11300	5860
Total	40000	36876	30881	59268	44668
Heat gain, Btu per hr,					
Conduction and sun effect	30666	19262	14466	14241	19949
Infiltration	4260	3515	2550	4680	2405
Total	34926	22777	17016	18921	22354
Ratio, window area to total wall area, percent	13.1	12.3	13.1	30.5	21.0
Heat loss, Btu per hr per 1000 cu ft	2430	2720	3130	3290	4800
Total number of degree-days in normal heating season	3885	3980	4075	5535	6202
Design temperatures, heating	In oil cases, 0 F outside, 70F inside				
Design temperatures, cooling	In all cases, 95F dry-bulb, 75F wet-bulb outside; 90F dry-bulb, 67F wet-bulb inside				

layout of the space and in the type and kind of construction. The volume of the occupied space ranges from 9300 cu ft to 18,000 cu ft. The residences include a two-story structure with basement, a one and one-half story with first floor slightly above ground, a one-story with basement, a one-story with floor slightly above ground, and a one-story with concrete floor slab directly on the ground.

In most cases the exterior walls, ceilings, and the floor are well insulated. The exterior walls consist of solid brick and wood siding, brick veneer, brick veneer and clapboard, clapboard and asbestos siding. The windows in all cases are storm sash or double glazing.

Sheet metal ducts are used to circulate the warm and cold air between the unit and the conditioned space. The supply and return grilles vary in location and design. One system employs ceiling outlet grilles and exterior baseboard return grilles; one ceiling outlet grilles with floor returns near the outside walls, one baseboard supply and baseboard return grilles; and two internal high sidewall supply grilles and low exterior baseboard return grilles.

A summary of the pertinent design information is given in Table 1. A brief description of type and kind of structure, together with several figures showing some construction details, follows.

Heat Pump Units. The heat pump units for the residences in Kingsport, Roanoke, and Coshocton, are the air-to-air type. Outdoor air is used as the heat source and air is used to supply the heating and cooling to the occupied space.

The heat pump unit for the residence in Abingdon is a water and air-to-air type. Both well-water and air are used as the heat source and air is used to supply the heating and cooling to the occupied space.

For the residence in South Bend, the heat pump unit is an earth and air-to-air type. Both the earth and air are used as the heat source and air is used to supply the heating and cooling to the conditioned space.

Each of the five heat pump units is contained in an enclosure 78 in. long, 60 in. high, and 40 in. deep. This enclosure houses the circulating fans, the compressors, heat absorbing and heat dissipating coils, filters, humidifiers, and all the automatic controls (except the room thermostats) to give complete, automatic year-round air conditioning.

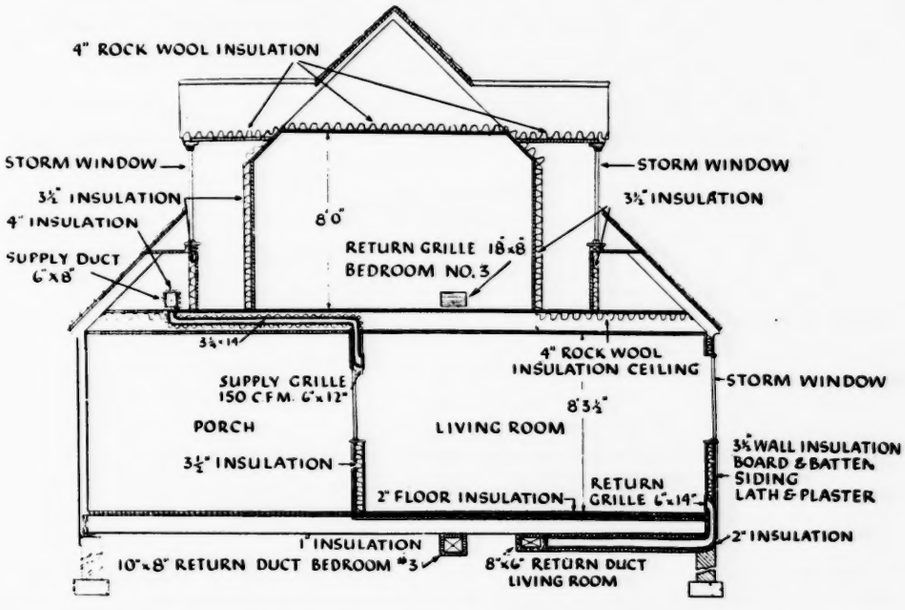


Fig. 2. Section through living room of Kingsport residence showing insulation on ceilings and sidewalls, and duct and grille location.

Each of the five units contains two entirely separate refrigerant circuits, each with its own compressor, coils, valves, and connecting piping. In the air-to-air type, the outdoor air is used as the heat source for both of the refrigerant circuits. In the water and air-to-air type, the well-water is used as the heat source for one of the two refrigerant circuits and the outdoor air for the other. In the earth and air-to-air type, the earth is used as the heat source for one of the two refrigerant circuits and the outdoor air for the other. In all of the five systems the air delivered to and returned from the occupied space is common to both of the refrigerant circuits.

The air-to-air type contains one 2 hp and one 3 hp, F-22 refrigerating compressor, one ¾ hp air fan for circulating air to and from the conditioned space, and one 1½ hp air fan for circulating air to and from the outdoors. The 1½ hp outdoor air fan was used on all five units in order to have all the parts identical. However, the fan is operating at a much slower speed on these two units using a dual

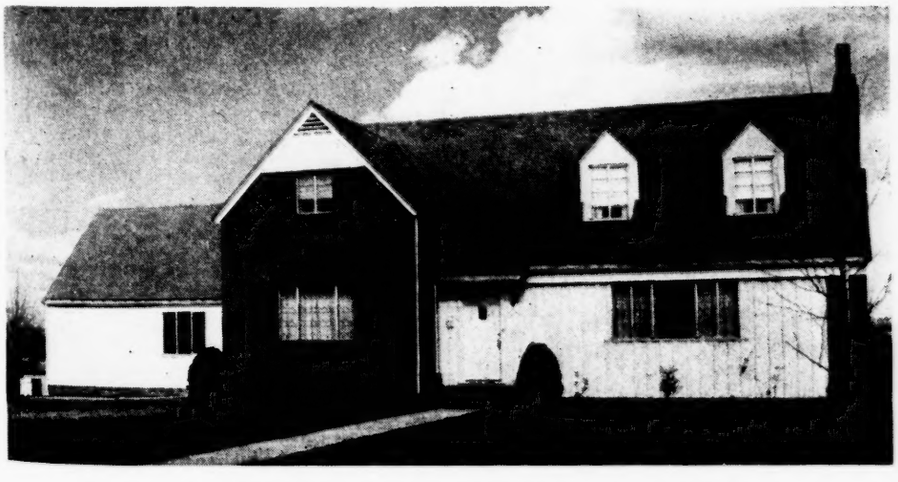


Fig. 1. Residence of D. W. Moulton, Kingsport, Tenn. Architect, Allen N. Dryden, Kingsport, Tenn.

Fig. 3. Residence of J. D. Moore, Abingdon, Va. Contractor, Virgil Odum, Abingdon, Va.

heat source, actually requiring the equivalent of a ¾ hp fan motor.

A front view of the pilot model heat pump unit with the front cover removed is shown on the title page. This is the air-to-air type. The five heat pump units were manufactured by the York Corporation, York, Pa. They are pilot models designed and assembled for experimental purposes and extensive field tests.

Kingsport, Tenn.

Construction. This residence is a 1½-story brick veneer and clapboard structure, has four rooms and bath on the first floor and two bedrooms, storage space, dressing room and bath on the second floor. The inside net volume of the occupied space is 16,450 cu ft, excluding the garage and laundry. The laundry and the garage are attached to the house proper. Fig. 1 is an exterior front view of the residence showing the garage on the left and the living quarters on the right. The walls are of wood stud construction having 3½ inches of rock wool insulation between the stud spaces and rock lath and plaster on the interior. Four inches of rock wool insulation is applied to the ceiling and two inches under the floors. Storm windows and doors are installed throughout the structure.

Distribution System. The heat pump unit is located in the laundry room in one corner of the structure. The warm air for heating and the cold air for cooling is delivered to various spaces on the first and second floors through metal ducts which connect to the high sidewall supply grilles. The air is returned from the spaces through baseboard return grilles which connect to branch ducts in the wall stud space. These branch return ducts in turn connect to the main return ducts located directly beneath the first floor. The supply ducts are covered with four inches of rock wool blanket, and return ducts with one inch insulating board. Fig. 2 is a section through the living room showing the type and kind of construction.

Heat Source. Outdoor air is used as the heat source for the heat pump unit. The air is taken into

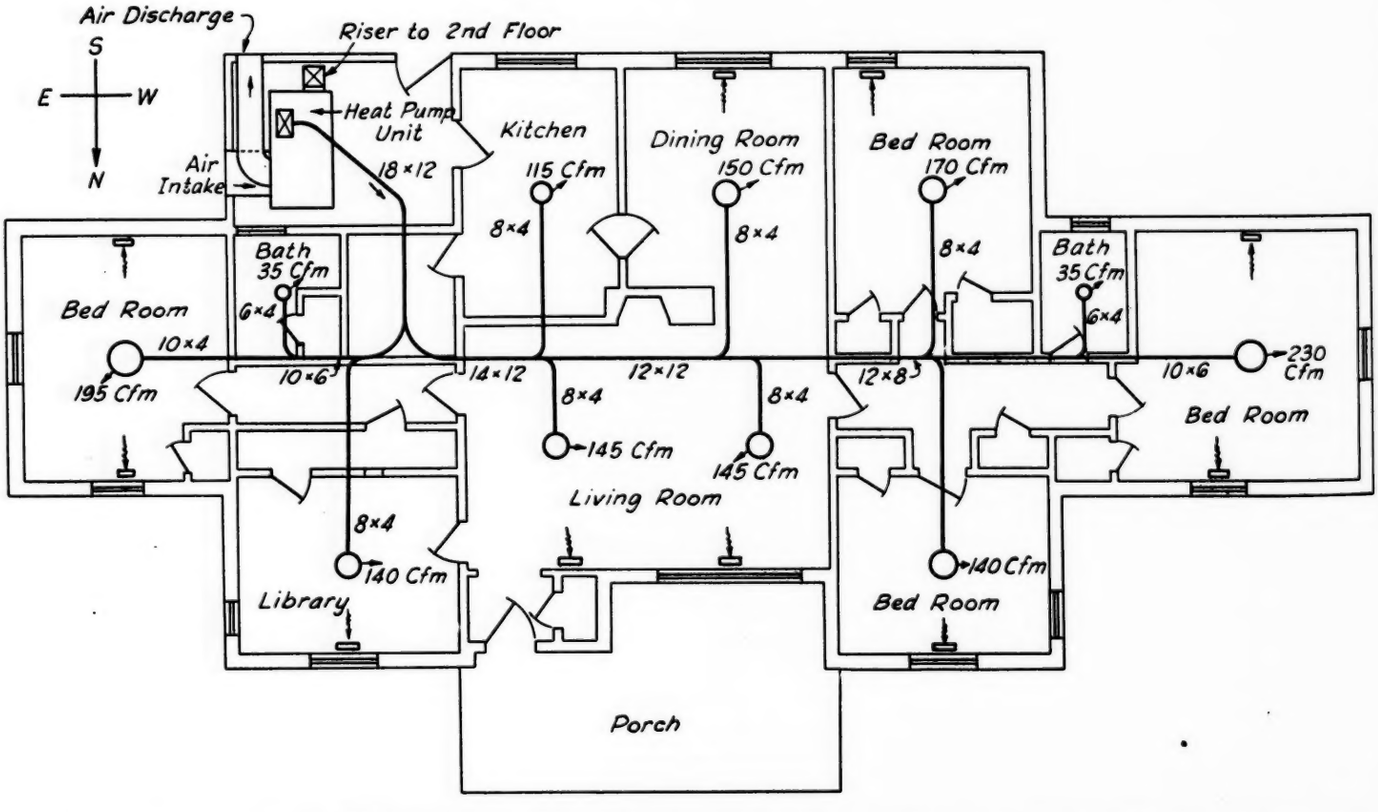


Fig. 4. First floor plan of Abingdon house with duct sizes and grille capacities indicated. The distribution system, indicated here by single lines, is a conventional forced warm air system, and is shown to illustrate the point that air distribution is no different with the heat pump than a conventional unit.

the unit from a low opening in the northeast wall and discharged from the unit through a higher opening in the same wall. These two openings are connected to the unit by insulated sheet metal ducts.

Abingdon, Va.

Construction. The residence is a one-story frame ranch-type structure of four bedrooms, living room, library, two baths, dining room, kitchen, pantry, and utility room. The inside net volume of the occupied space is 13,550 cu ft, excluding the utility room. Fig. 3 is an exterior front view of the residence. The exterior surface is asbestos siding on wood sheathing with rubberized moisture-proof strips between joints, backed up by four inches of blanket type fiber glass insulation in the stud space, rock lath plasterboard, and Zonolite aggregate plaster. Four inches of insulation is installed above the ceiling and two inches below the floor. Storm windows and doors are installed.

Distribution System. The heat pump system is located in the southeast corner of the utility room. The warm air for heating and the cold air for cooling is delivered to the occupied space by overhead metal ducts and returned to the unit through horizontal ducts underneath the floor. The air is supplied to the various rooms through ceiling outlets and returned from the rooms through baseboard sidewall grilles. The supply ducts are insulated with four inches of fiber glass insulation, and return ducts are insulated with two inches of pressed fiber glass insulation. The first floor plan, Fig. 4, shows the supply duct system and the loca-

Fig. 6. Residence of E. B. Setzler, Roanoke, Va. Contractor, J. C. Garnard, Roanoke, Va.

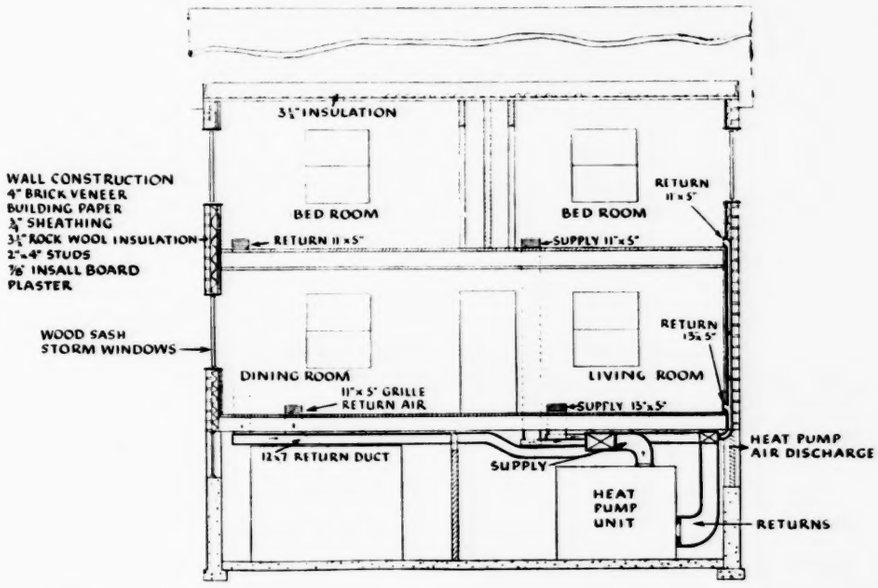


Fig. 7, above. Section through Roanoke house showing baseboard supply and return grilles, insulation and ducts.

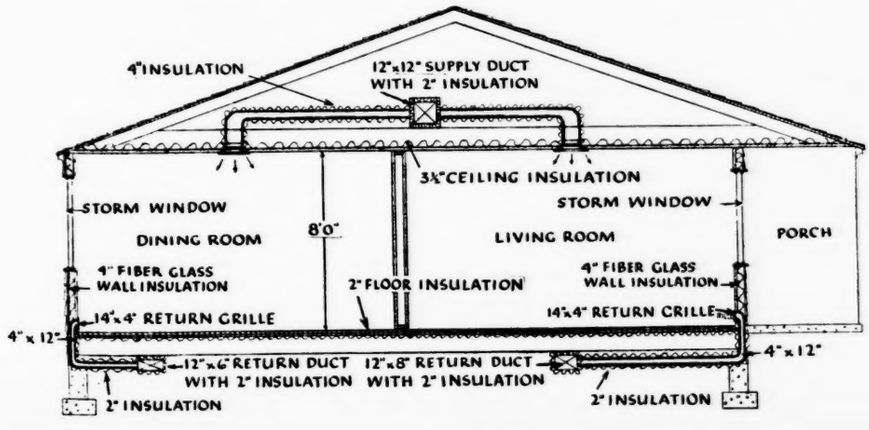


Fig. 5, left. Section through living and dining rooms of Abingdon house, showing insulation and duct and grille location.

Fig. 8. Residence of Oliver H. Stevning, Coshocton, Ohio. Architects, Tibbals-Crumley, Musson, Columbus, Ohio.

tion and type of supply and return grilles, while Fig. 5 is a typical section through the structure showing the type and kind of construction.

Heat Source. Air is used as the heat source for one of the two refrigerant systems. The air is taken into the unit through an opening in the east wall of the utility room and discharged from the unit through an opening in the south wall. These openings are connected to the unit by means of insulated sheet metal ducts.

The second refrigerant system uses well-water as the heat source. Approximately 15 gpm of well-water with a temperature of 56F is delivered to the unit. After the heat is abstracted from this water it is discharged to a surface drain at the rear of the property.

Roanoke, Va.

Construction. The residence is a two-story brick veneer structure consisting of six rooms having a volume of 9850 cu ft, excluding the basement and garage. Fig. 6 is an exterior view of the house. The walls are of wood stud construction having 4-inch brick veneer on the exterior with 3½ inches of rock wool insulation between the stud space and ⅞-inch insulating board, and lath and plaster on the interior. Three and a half inches of insulation is applied above the ceiling. Storm windows are used throughout the structure.

Distribution System. The heat pump unit is located in the southwest corner of the basement. The warm air for heating and cold air for cooling is supplied to and returned from the occupied space in the first and second floors by means of metal ducts. The main supply duct and the main return duct systems are located immediately below the first floor joists and are exposed to the basement and garage. These two horizontal duct systems connect to the baseboard supply and baseboard return grilles by branch ducts located in the wall joist space.

Fig. 7 shows a typical section through the living room and dining room. In general, the baseboard return grilles are located in the outside walls having the largest heat loss, and supply grilles in the interior walls. However, in a few cases, due to the construction of the residence and the arrangement of the space, it was necessary to locate the supply as well as the return grilles in the outside walls, but in no case in the same wall. The exposed ducts in the basement and garage are not insulated but provisions have been made to add the insulation in the future, if found necessary. It was thought the losses from the duct system would supply some heating and cooling to these areas.

Heat Source. Outdoor air is used as the heat source for both of the refrigerant systems. The air is taken into the unit from an opening in the south basement wall and discharged from the unit through an opening in the west wall. These two openings are connected to the unit by insulated sheet metal ducts.

Coshocton, Ohio

Construction. The residence is a one-story frame and masonry struc-

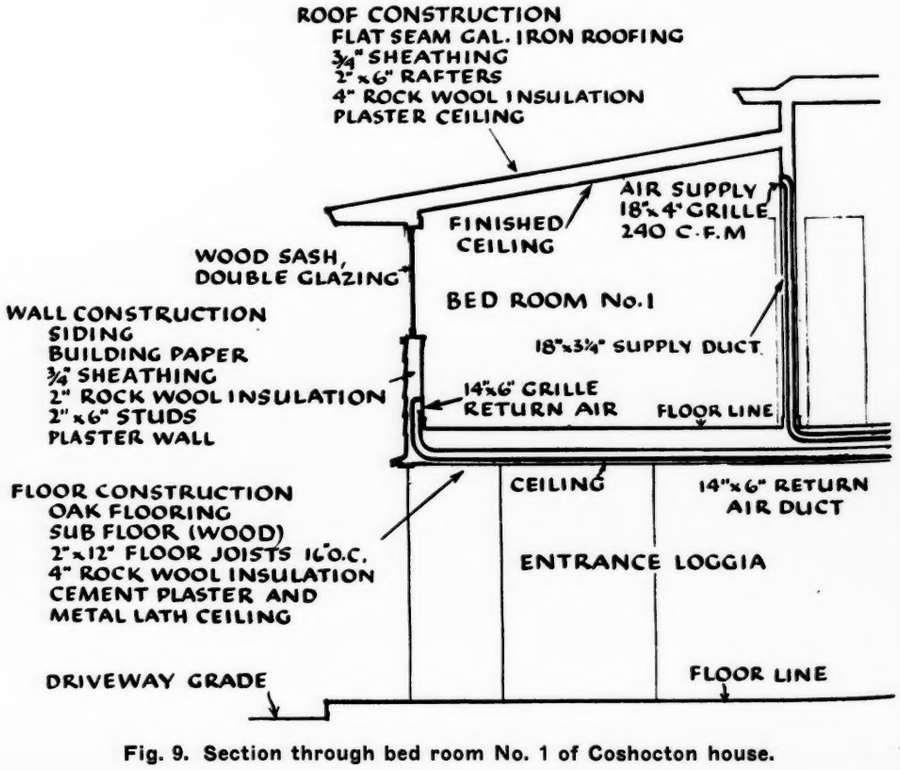


Fig. 9. Section through bed room No. 1 of Coshocton house.

ture consisting of a living room, dining room, den, kitchen, three bedrooms, two baths, and a dressing room, with a car-port and entrance at the basement level. Fig. 8 is a southwest exterior view of the residence. The exterior is a combination of solid brick masonry and wood siding on wood studs backed up by one inch of insulation board, and lath and plaster. The brick walls have a core of one inch of insulation board and the brick face is exposed inside as well as out. Four inches of insulation is installed above the ceiling. Fixed double windows or storm sash are used throughout the structure. The inside net volume of the conditioned space is 18,000 cu ft, excluding the basement.

Distribution System. The heat pump unit is located in the northeast portion of the basement. The warm air for heating and the cold air for cooling is supplied to and returned from the occupied space by means of metal ducts. The main supply duct and the main return duct systems are located below the first floor. These horizontal supply duct systems connect to high sidewall outlet grilles and the horizontal return duct system connects to the baseboard return grilles by branch ducts located in the wall stud space. Both the supply and return ducts are covered with one inch of insulation.

Fig. 9 is a typical section through No. 1 bed room.

Heat Source. Outdoor air is used as the heat source for the heat pump unit. The air is taken into the unit from an opening in the north wall and discharged through an opening in the east wall. These two openings are connected to the unit by insulated sheet metal ducts.

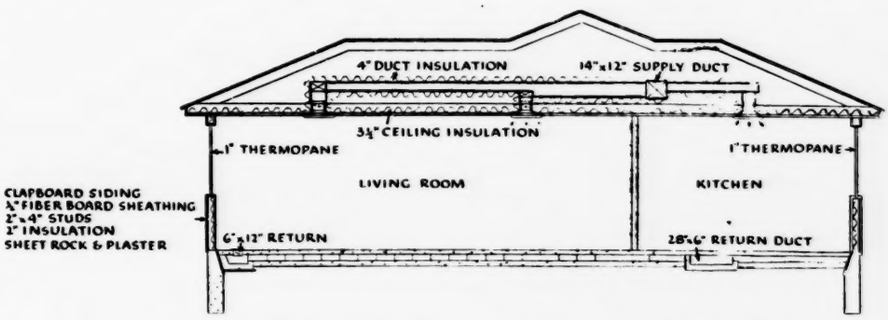


Fig. 11. Section through living room and kitchen of South Bend house.

South Bend, Ind.

Construction. The house has a clapboard siding exterior mounted on ½-inch fiber board insulating sheathing over typical wood stud framing. The interior consists of sheet rock and plaster with two inches of insulation between the wood stud framing, and four-inch insulated blanket is installed in the ceiling joist space. The windows are one-inch thermopane. The residence is a one-story structure of six rooms having a volume of 9300 cu ft, excluding the garage. Fig. 10 is an exterior view of the South Bend house.

Distribution System. The heat pump unit is located in the northwest corner of the garage. The warm air for heating and the cold air for cooling is supplied to the occupied space on the first floor by means of metal ducts. This supply duct system is located immediately above the ceiling joists and is exposed to the attic. This horizontal duct system connects to ceiling outlets, located in each of the occupied spaces, by branch ducts. The air is returned from the various spaces to the heat pump unit through a floor return system. This floor return system, directly underneath the 2½-inch reinforced concrete floor, consists of 4 in. x 12 in. x 12 in. cell tile installed so that a center concrete duct joins two parallel ducts along the exterior wall. The air from the space goes through the floor return grilles into the concrete ducts along the exterior walls. From these concrete ducts the air goes through the cells of the tile to the center duct which connects to the heat pump unit. An alternate return system has also been provided to take the air directly from the space to the heat pump unit by an overhead duct in the attic space.

The supply ducts are covered with four inches of insulation. One inch of insulation is installed on the inside of the foundation wall, and three feet from the face of wall around entire perimeter. Fig. 11 is a section through the living room and kitchen showing duct and grille installation.

Heat Source. Air is used as a heat source for one of the two refrigerant systems. The air is taken into the unit through an opening in the west garage wall and discharged from the unit through an opening in the north wall. These openings are connected to the unit by means of sheet metal ducts. The second system uses the ground as the heat source. Nine two-inch IPS wrought iron pipes, varying in lengths from 20 to 30 feet, were driven vertically into the ground. A one-inch wrought iron pipe was inserted in each of the larger pipes to within about three inches of the bottom in

Fig. 10. Residence of Virgil Place, South Bend, Ind. Contractor, Crown Development Co., South Bend, Ind.

such a manner to cause the circulating non-freeze solution to flow first through the annular space and then through the inside of the one-inch pipe. Fig. 12 shows how the

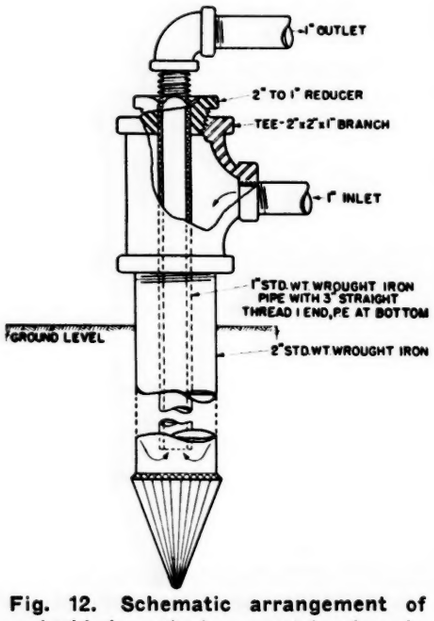

1" OUTLET
2" TO 1" REDUCER
TEE-2"x2"x1" BRANCH
1" INLET
1" STD. WT WROUGHT IRON PIPE WITH 3" STRAIGHT THREAD I END, PE AT BOTTOM
GROUND LEVEL
2" STD. WT WROUGHT IRON

Fig. 12. Schematic arrangement of embedded vertical concentric pipes in South Bend installation employed when using ground as heat source.

one-inch pipe was installed in the two-inch pipe to make two parallel groups of piping.

Performance Tests

Testing instruments are installed on each of the five systems to obtain all possible operating and performance data during both the heating and cooling season.

The instruments showing the compressor operation include discharge and suction pressure recorder, outdoor air-relative humidity recorder, supply air and return air temperature recorder.

Ten electric meters are used to record the electric energy consumptions and load characteristics of the two compressor motors and all auxiliary equipment. Fig. 13 shows the heat pump unit and two of the pressure recorders of the South Bend system.

The electric range, electric hot water heater, and electric lights are on separate meters in order to be able to determine their relationship to the heat pump load.

The wattmeter on the main feed to the heat pump compressor motors is equipped with a chromograph pen which is energized, to indicate on the recording chart when the system changes to the defrosting or cooling cycle.

Plans for Analysis of Data

Complete performance data will be taken on all five of the units during the 1948-49 season and will be extended to the 1949-50 season, if necessary, to get more complete and reliable results. These data will include typical operating curves of discharge pressure, condensing temperature, suction pressure, heating output, and cooling output at various outdoor temperatures. The quantity and temperature of the supply and return air as well as temperature maintained in the space will be recorded throughout the period.

Typical energy consumption curves will be made for all the heat pump equipment and the other electric appliances in the residences.

A correlation will be made of all the test data obtained so that the coefficient of performance and cost of operation can be determined at various outdoor temperatures.

A detailed log will be kept of the operating difficulties and necessary design changes. The frequency and time required for the defrosting cycle as well as the reaction of the occupants will also be recorded.

All of the test data for the five residential systems will be summarized and correlated. These summarized data, together with comments and conclusions, will be made available in a useful form at the end of the test period.

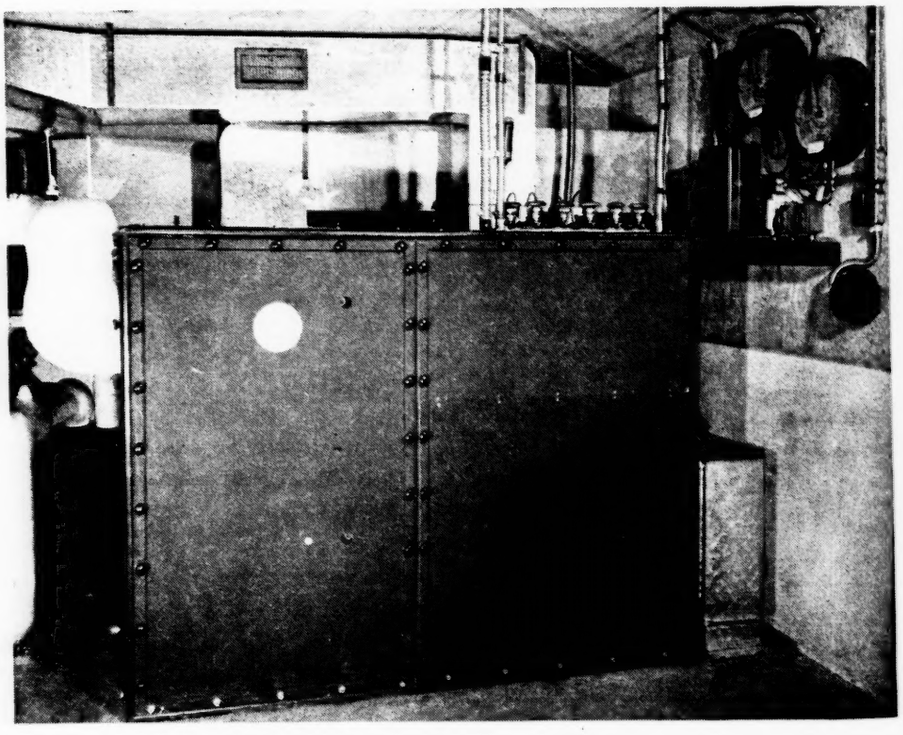


Fig. 13. York heat pump in South Bend house, showing return and outside air discharge ducts, insulated piping from ground (left), and refrigeration pressure recorders (right).

Bindin

SELECTING THE RIGHT VALVE

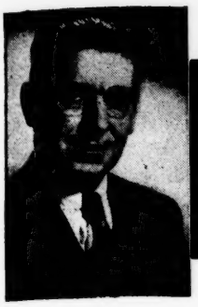
The selection of the right type of valve in order to obtain the best possible piping service is a matter of considerable importance. It involves consideration of how well a valve will work, how long it will last, and both of these depend on how well the valve was chosen for its job.

The following is a condensed summary of information on selecting the right valve based on material furnished through the cooperation of Crane Company.

GENERAL	
Material	Good valve service begins with choosing the right metal; body and bonnet metals usually determine valve ratings. Don't use brass for temperatures over 550F. Don't use iron for temperatures over 450F. Use steel for services above 550F; use steel for lower temperatures if the working conditions are severe.
Type of Valve	Suitability of a valve is determined by its design. While their design details may vary, all valves come from four basic types: Gate, Globe, Check, and Plug.
GATE VALVES—DESIGN	
Service Characteristics	Flow through gate valves is straight-way. They are best for lines where unrestricted flow is important—in pump lines, main supply lines, and for stop-valve service. They are ideally suited for service in which valves are infrequently operated, with disc open wide or fully closed. Gate valves are not suitable for throttling services (flow regulation). They are usually more difficult to repair than globe valves. Gate valve design is practical and safe in any size required.
Disc Design	Double disc type should be installed with stem vertical, handwheel up, as precaution against possible jamming of the disc spreader mechanism. This type is good for non-condensing gas and liquid services at normal temperatures. The wedge-disc type can be installed in any position without danger of the disc jamming. It is recognized as best for steam services. Solid wedge disc has no loose internal parts to rattle or get damaged in vibrating services. Has highest resistance to pressure strains.
Stem Operation	The rising stem, outside screw and yoke type is acknowledged as best construction for high temperature services. Stem threads are not subjected to severe thermal reactions. Outside screw permits easy thread lubrication. Good for corrosive services and hot oil (in refineries) as stem threads are not in contact with material in line. Position of stem indicates position of disc. This type must have adequate headroom for rise of stem when valve is opened. The rising stem, inside screw type is the most common stem design in brass and small iron gate valves. Position of stem indicates position of disc. Stem rises above bonnet when disc is raised. Must have adequate clearance for operation and not be exposed to damage. The non-rising stem, inside screw type is ideal where headroom is limited. Stem does not rise when disc is raised. Position of disc is not indicated outwardly. Undesirable for high temperature services as stem threads are constantly in-contact with material in line. Wear on packing is minimized since stem merely turns when operated.
ANGLE VALVES	
Design Characteristics	Angle valves have same basic characteristics as globe valves, and are available in a similar range of disc and seat designs. Used when making a 90° turn in a line, an angle valve gives less restriction to flow than the elbow and globe valve which it displaces. In addition to reducing number of joints in a line, it saves installation time.

SELECTING THE RIGHT VALVE

CHECK VALVES	
Design Characteristics	Check valves come in two basic types—swing and lift. Flow through a swing check is straight-way—same as in gate valves. Lift check design, like a globe valve, requires a change in the direction of flow through the valve body. A safe rule for choosing check valves: use swing checks in combination with gate valves; use lift checks with globe and angle valves.
GLOBE VALVES—DESIGN	
Service Characteristics	Globe valves are ideally suited to flow regulation (throttling) by hand. Convenient and quick regrinding feature of globe valves makes them highly suitable for severe services requiring frequent repair of valves. Good for frequent operating services; the short stem travel of globe valves saves operators' time. Globe valve design causes a change in the direction of flow through valve body, with increased resistance to flow. On liquid lines, pump lines, etc., this may be objectionable.
Disc Design	**Conventional disc** type widely used and highly satisfactory for average working conditions. Has narrow seat bearing; easy to regrind, but subject to easy injury by dirt and foreign matter. For liming conditions or hot oil service in refineries, the narrow bearing aids in breaking down deposits on seating surfaces. **Plug disc** type is best for throttling (flow-regulation). Gives fine, accurate flow control. Wide seating surfaces reduce chances of damage by dirt and foreign matter. Excellent for wide variety of severe services such as: drip and drain, soot blower, blow-off, and boiler feed. **Composition disc** type is unsatisfactory for throttling. Availability of various disc materials permits wide usage for air, steam, hot and cold water, oil, and gas. Slip-on disc holder allows quick service changeover and simplifies valve maintenance.
Stem Operation	**Rising stem, inside screw** type is simplest and most common stem construction. Stem rises when valve is opened, thus indicates position of disc. **Rising stem, outside screw and yoke** is best for steam and high temperature fluids. Stem threads are outside of valve and thus not subject to severe thermal effects. Exposed stem threads permit easy lubrication. Preferred for corrosive services and hot oil in refineries, as stem threads are not in contact with material in line. Position of stem shows position of disc.
BONNET CONSTRUCTION—GATE AND GLOBE VALVES	
Union Bonnet	Union bonnet is easily dismantled and reassembled without danger of injury to body-bonnet bearing surfaces. Ideal for service requiring frequent inspection and cleaning of internal valve parts, and for quick servicing of composition disc valves.
Bolted Bonnet	Bolted bonnet is most practical and commonly used design for large valves and temperature services. Bolts are easily removed with small wrench. Gate valves are also available with clamp-type bolted bonnet providing easy dismantling and reassembly.
Screwed Bonnet	Screwed bonnet is the most common construction in small size valves, both gate and globe, for low pressure liquid services not requiring frequent dismantling of valve. Not recommended where vibration and severe conditions might strain and distort valve body.
PLUG VALVES	
Design Characteristics	Plug valves are similar in some respects to disc valves, but due to the seating angle the "plug" has more area in contact with the seat. Therefore the plug valve offers high resistance to the cutting effects of dirt, scale and grit. Use plug valves when the fluid is dirty, such as in drip and drain lines, soot blowers, blow-off, boiler feed, and so on.



Experience is my Classroom

By T. W. REYNOLDS

• JUST A MATTER OF PHYSICS

Perhaps 90% of our heating and ventilating difficulties would never happen if all involved in the trouble had a fair understanding of ordinary high school physics. For example, the owner who wants to build a chimney only 40 ft high when it should be 100 ft high. He argues that 40 ft high, plus a 60 ft run of breeching to the chimney adds up to 100 ft. Learning about this 60 ft horizontal run, you tell him that now the chimney must be even higher than 100 ft. He replies that if this be so, then he will get around all of it by making the new chimney of twice the diameter it otherwise would have been.

From the plant he takes you to the boiler room in his home where there is less steam than he would like. Mere opening of the ash pit door a slight bit seems to be the answer, but he is worried now because he can no longer hear the draft, as he phrases it. Seems that when the ash pit door is closed, it is not tight, and the resulting high velocity of infiltrating air at cracks makes the noise which he calls a nice draft.

• CHIMNEYS

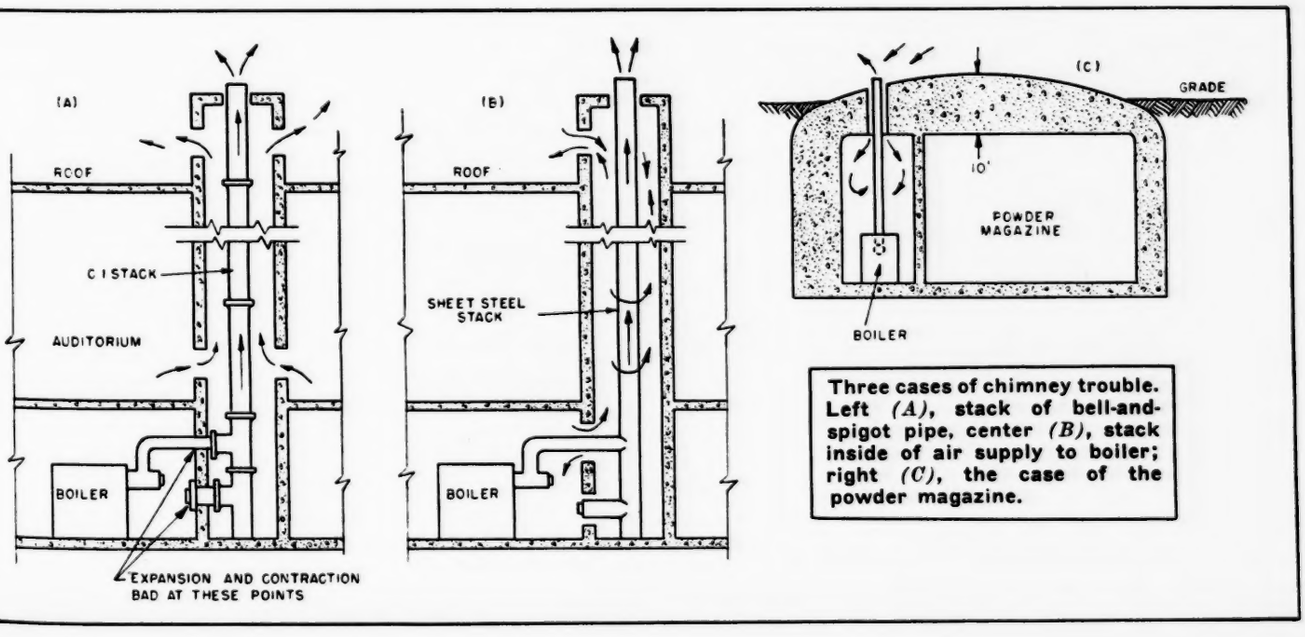
At one time I saw a chimney of cast-iron bell and spigot pipe enclosed in a shaft ventilating an auditorium (*A*). The job was causing trouble. The stack expanded and contracted, causing leaks at joints, and the chimney draft was further retarded due to heat in the flue gas being given up to the vent shaft. The rising temperature in the vent shaft did on the one hand keep down the extraction of heat from the flue, but its wiping motion wiped out all that gain and more besides.

I once heard of a sheet metal chimney enclosed in a brick cold air duct coming down the building to provide necessary air directly to the boiler (*B*). The main idea was to heat that air for nothing from waste heat, but it didn't work. The metal chimney, which, incidentally, was inaccessible for repair, lost some of its heat to the duct and also some of its draft. Meanwhile the cold air dropped down the duct part way, then some of it turned around, for it was hot, and therefore could not go down.

Recent thinking is that cold air for combustion should be taken from the same level as the outlet of the chimney; then any down-draft would affect both the cold air downcomer to the boiler and the chimney alike, assuming the chimney to be enclosed in the duct as previously described. I don't believe this would work, even with the chimney well insulated to prevent heating of the cold air, because a given down-draft would be affected differently from another by differing entrance shapes and resistances.

I did once see something similar to the last mentioned. It was in a powder magazine which was mostly under earth and with roof and sides over 10 ft thick, and as a consequence only one opening to roof (*C*). Nothing could appear above the roof, so down-drafts were worried about and finally guarded against by running the smoke pipe up through the hole in the concrete.

Note: Mr. Reynolds is Chief, Air Conditioning Division, Abbott, Merkt & Co., Engineers, New York.



Three cases of chimney trouble. Left *(A)*, stack of bell-and-spigot pipe, center *(B)*, stack inside of air supply to boiler; right *(C)*, the case of the powder magazine.

The hole worked fairly well as a ventilator for the separated boiler room, but down-drafts worked at times against the chimney and affected the draft on the boiler without being balanced by the down-draft in the hole. It seems that any down-draft in the hole was cushioned in the greater space of the boiler room and was therefore unnoticed at the boiler itself.

• FINDING A USE FOR SMOKE

The modern test laboratory of a plant making air diffusers is a revelation, especially when it comes to the various ways of making visual the flow of air currents. By use of different colors for two bodies of air, one can readily detect the action of one body upon the other. Then, too, there are various smoke producing devices, each of which has its field where its use is more advantageous than some other.

Lampblack is excellent for smudging tests, but it gets on you and on everything else. It is there even when not visible on the things you handle and soon blackens the hands. Titanium tetrachloride makes a goodly volume of smoke, but covers testing instruments with hydrochloric acid. As for the sulphur in the smoke bomb or torch, though one doesn't like the odor, the sulphur does make a nice dense smoke of a yellow color. This shows up well against the colored background of a room in color photography. For other use, a sulphur may be obtained which gives off a white smoke.

When there is a crowd to view an exhibit in the test room, one can avoid too much odor by using potassium chlorate and sugar, fifty-fifty by volume, and the finer the sugar the better the results. The disadvantage of this mixture is the permanent setup required because of the heat generated and the necessary agitation of the chemical, both mechanically and by air. The white smoke from this mixture can be used in colored movies for duct outlet discharge, while the yellow smoke from sulphur is being produced by a torch held near the outlet. The mixing action then becomes very clear, providing you keep your eyes on the smoke and not the girl moving the torch from point to point.

Perhaps the most useful smoke device is the aerosol gun more commonly used with insecticide. Plugged in the nearest electric outlet it generates heat in a few minutes, converting the contained liquid into a dry vapor. Discharge is controlled by a valve and the gun then set where desired.

• SELLING PRODUCT—NOT TALKING PRODUCT

When should a salesman promote his product? It's a hard question to answer. To the engineer who analyzes his own reactions, it does seem that there are certain times which are better than others, and other times when the salesman's efforts will be lost and possibly more gained had there been no effort. A too busy engineer may courteously allow the story to be told, yet he thinking all the time of his most pressing problem. On the other hand, a not too busy engineer may not be over enthusiastic with no business around, unless he is awaiting the go signal on business already secured.

If the salesman has regular entry to the customer's office, sooner or later he can promote his particular item of product at the most opportune time. It has always seemed to the writer that this best time was when there is a job in the office having a specific use for product of the type the salesman desires to promote. The engineer has then to make up his mind on a specific application and the salesman has a more apparent legitimate reason for talking the product.

• CLEANING OUT THE CHIMNEY

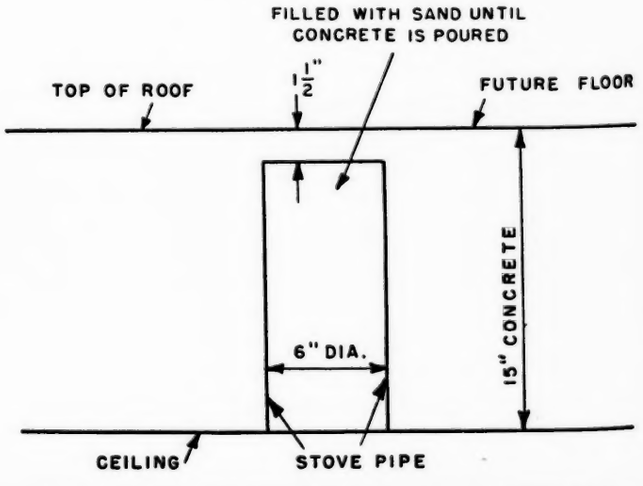
A chimney for least fire hazard and greater efficiency does not require thorough cleaning so much as it does frequent cleaning. It may be cleaned manually, or by vacuum exhaust, or by adding to the fuel bed when hot any of the following:

Common salt (rock or ice cream salt): This is cheap, easy to handle, and available, but is not the most effective; *metallic zinc* as a dust or in small granules is often used, or better still a mixture of salt and 10% of the zinc dust; another mixture is one part of *dry lead* and five parts of common salt; shake well together in a can and use one or two teacupfuls at an application, washing the hands after using, as lead is poisonous; old dry cell *batteries*, especially if chopped up, are also used.

• LOOKING BACK INTO THE FUTURE

Many buildings are built with provision for extending several stories upward at a future date (known or unknown). In such cases, the roof is constructed as a future floor.

The future arrives, and it then becomes quite expensive to knock out holes in the heavy concrete floor for the many heating and plumbing risers, unless provision has been made—somewhat as shown in the accompanying sketch. Here we have a 6-in. stovepipe which, when filled with sand for a body until the concrete is poured, provides easy extension of risers some day. Concrete 1½-in. thick is left over the stovepipe hole as a protection against someone stepping on it and spoiling the roof. This thin slab can then be easily knocked out when desired by means of a long pole operated from the floor below. It's a simple thing, this provision for the future but, like many a simple thing, frequently overlooked.



Detail of stove pipe insert in roof slab for future risers.

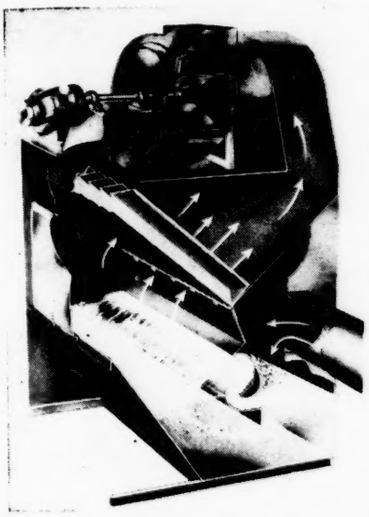
NEWS OF EQUIPMENT AND MATERIALS

Roto-Clone

NAME—Type N Roto-Clone, Design 2.

PURPOSE—For the collection and control of dust generated in manufacturing and process operations.

FEATURES—Unit has been re-designed to permit wider application and improved performance. Unit cleans the air by a combined action of centrifugal force and an intermixing of water and dust-laden air. Impeller is inclined slightly from the perpendicular to obtain better performance. This inclination reduces the head of water in the impeller which results in a lower pressure loss, it is said, over the entire operating range without any reduction in the volume of water in the impeller. Unit, through its thorough wetting action, collects dust without clogging. Unit can be operated from 50 to 120% of its nominal rating without affecting its efficiency. All sizes are available in either manual clean-out, sludge ejector, or hopper bottom arrangement.



OPERATION — Air flowing through the impeller at high velocity, carries the water with it in a heavy turbulent sheet along the inner surface of the lower impeller blade at such speed that it is projected across the passage and reverses its direction to follow the curve of the upper blade. From here it is ejected as a thick curtain that blankets the clean air chamber. The air stream passes twice through this water curtain. The centrifugal force exerted by the rapid change in flow direction causes the dust particles to penetrate the water film and thus become trapped. Entrained moisture in the cleaned air is removed by a water eliminator. Water in reservoir is continually reused and no pumps or nozzles are required since the water curtain is produced by the air flow. Water level is maintained by an overflow weir.

LITERATURE AVAILABLE — Bulletin 277-A.

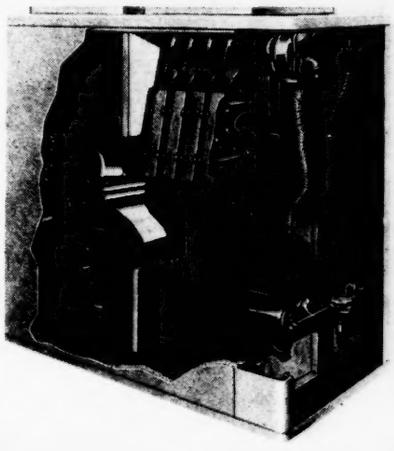
MADE BY — *American Air Filter Co., Inc., Louisville 6, Ky.* **164**

Thatcher Furnace

NAME—Comfortmaster GA series.

PURPOSE — Gas-fired furnace for space heating.

FEATURES — Burner is of the one-piece cast iron type with raised drilled port. Burners are self-leveling. The venturi air mixer fits into the burner with a tapered machine-tooled joint. M-H controls are supplied, including an electric gas valve and transformer, combination fan limit control. A safety thermocouple pilot is used. Cast iron sections are designed to permit staggered fire travel. Heat extractor has tongue-and-groove joints fitted with asbestos gaskets. Sections have removable clean-out plates secured by wing-nuts so that section can be removed within a short time. Legs are adjustable to level the heat extractor if the basement floor is uneven. Humidifier unit is entirely automatic in its operation.



SIZES AND CAPACITIES—From 60,000 to 144,000 Btu at the bonnet.

LITERATURE AVAILABLE—Folder.

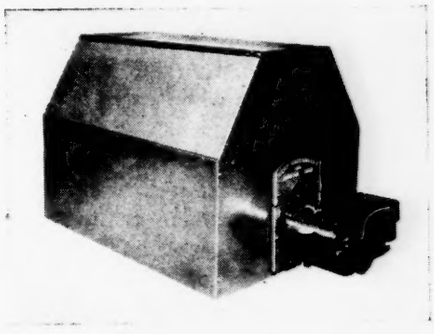
MADE BY—*Thatcher Furnace Co., Garwood, N. J.* **165**

Comfort-Aire Furnace

NAME — Comfort-Aire low boy oil or gas-fired furnace.

PURPOSE—Space heating for small homes without basements.

FEATURES—Unit is small and compact and may be hung from the floor joists or mounted on a shallow footing without the need of digging a pit under the average small home. Unit is built in both horizontal type as a complete air conditioning unit or as a gravity heater with automatic controls. Employing long heat travel through 90 inches of 8-inch radiator tubes, manufacturer claims high combustion efficiency is achieved with a minimum heat loss. A baffled combustion chamber is said to eliminate the need for a refractory lining or brick work. The baffle diffuses and deflects the flame upward.

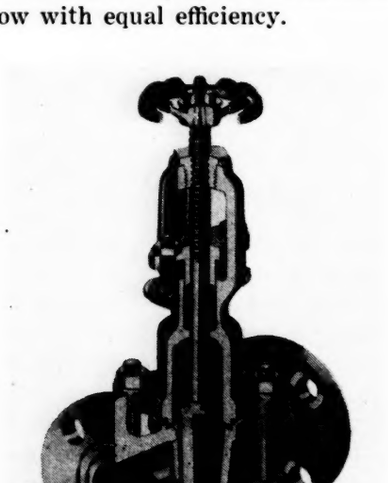


SIZES AND CAPACITIES—Two heating capacities available—one employs a ¼-hp, 1200 cfm blower which delivers 65,000 Btu at the bonnet, and the other a 1/6-hp, 800 cfm blower which delivers 55,000 Btu. Fuel oil consumption varies from a maximum of 1 gal per hr to a minimum of 1/12 gal per hr. Furnace is 32-inch high, 26-inch wide, and 36-inch long.

MADE BY—*Heat Controller, Inc., Addison, Mich.* **166**

Crane Plug Valve

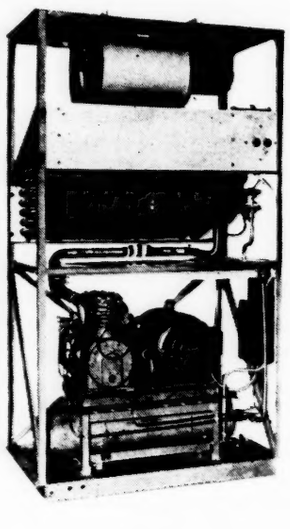
NAME—Crane plug valve.
PURPOSE—Valve that is capable of performing as a throttling valve, or as a valve to provide unrestricted flow with equal efficiency.



FEATURES—A circular plug disc resists cutting action of fluid on seating surfaces when valve is used for throttling service. Body and disc seats are machined to the same taper so as to permit interchangeability and to provide true alignment for tight seating. Guides prevent the turning of discs and assure seating in the same position each time. A minimum of four bolts are used for bolting the bonnet. The stuffing of yoke design provides ample room for easy repacking. All sizes have outside screw and yoke design. Yoke is cast integral with bonnet for increased strength.
SIZES AND CAPACITIES — Available in sizes from ½ to 2 inches, and with flanged or screwed ends.
LITERATURE AVAILABLE—Folder.
MADE BY—*Crane Company, 836 S. Michigan Ave., Chicago 5, Ill.*...**167**

Brunner Room Cooler

NAME—Brunner room cooler, type BAC-59.
PURPOSE—Space cooling.
FEATURES — Low speed condensing unit is installed with spring mounting on the compressor base and flexible gas lines to prevent transmission of noise and vibration to the cabinet proper. Heavily finned water tube and large liquid reservoir are used to reduce the amount of cooling water required. Cooling coil, consisting of six rows of tube, is made of copper tube and aluminum fins. Tubes are mechanically expanded to permit a firm bond between the tube and fins. All connections are copper welded. Coil is supplied with refrigerant through a multi-port expansion valve to insure proper distribution of refrigerant to all circuits. A heating coil can be supplied at the customer's option. A single wheel slow speed fan is installed to deliver 1800 cfm. Standard size, replaceable filters are used. Controls allow for operation of the blower while the compressor is idle. Operation of the room conditioner is entirely automatic, responding to a thermostatic switch. Should the thermostat become inoperative the unit will be shut down by the action of an auxiliary pressure switch. Unit will also



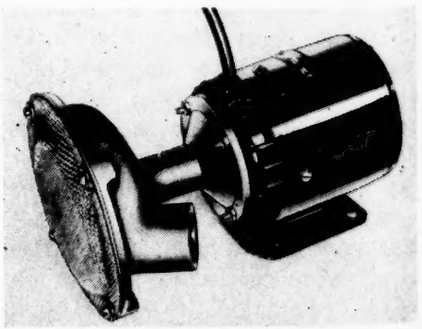
shut down when the discharge pressure becomes too high.
SIZES AND CAPACITIES—5 tons of refrigeration. Weight, 950 lb.
LITERATURE AVAILABLE—Illustrated folder.
MADE BY—*Brunner Manufacturing Co., Utica 1, New York.*.....**168**

Chrome Lock Gasket

NAME—Chrome Lock zinc chromate impregnated gasketing material.
PURPOSE—Material for protective gasketing.
FEATURES—Material is especially compounded of impregnated felt containing zinc chromate as a corrosion inhibitor. It is used for gasketing or sealing between all types of faying surfaces such as flanges and lapped or butted joints. Under pressure the resins traverse within the felt and are extruded into the faying surfaces to form a positive air and water dam. Material has an adhesive backing. Once pressure is removed, it is said to have a 75 to 100% recovery. Material is non-inflammable and non-soluble in water or saline solutions.
SIZES AND CAPACITIES — Available in 1/32, 1/16, 1/18, and 1/4-inch thicknesses, and widths from 3/16 to 72 inches.
MADE BY—*Products Research Co., 5426 San Fernando Rd., Glendale, Calif.*..... **169**

Thompson Water Pump

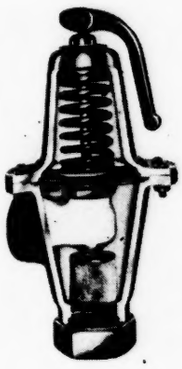
NAME—Thompson centrifugal water pump.
PURPOSE—Pump capable of circulating water or other coolants in refrigeration, air conditioning, and ventilation work.
FEATURES—Pump body and impeller are machined from brass castings. The inlet cover plate is a brass stamping. Impeller is mounted directly on an extended stainless steel motor shaft. If desired, an inlet No. 12 mesh brass screen may be obtained. Unit is totally enclosed and has double ball bearings. Unit is rustproof.
SIZES AND CAPACITIES — Available for operation on 115- or 230-volt, 50 or 60 cycle, a-c, and 115- or 230-volt d-c. Pump capacity is 10 gpm at a 5-ft head. Motor is 1/25 hp.
MADE BY — *Thompson Products, Inc., Cleveland 17, Ohio.*.....**170**



B & G Relief Valve

NAME—Bell & Gossett combination safety and relief valve, No. 300.

PURPOSE—Valve to relieve pressure in water line at a predetermined operating-pressure condition.



FEATURES—Valve is constructed according to the A.S.M.E. code and is rated to have a capacity of 318,000 Btu per hr. Valve seat and disc are made of monel metal ground and polished to a fine finish to assure that the valve will close tightly. Design of valve assures that it will be wide open with an increase of only a few ounces of pressure above that required to open the valve. Valve has a safety type of strainer which permits the valve to operate even though the strainer might be completely filled with foreign matter collected from the heating system. Basket is built like a relief valve disc so that it will lift up and pass water should the mesh of the basket become filled at any time. Basket is large in size and is built in an upside down position so that the foreign matter will drop back into the heating boiler.

SIZES AND CAPACITIES—At low flow, valve discharges about 10 gph. When wide open and with 30-lb pressure at the inlet of the valve, discharge is 420 gph.

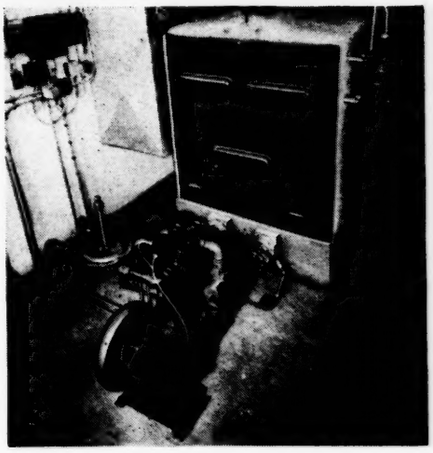
MADE BY—*Bell & Gossett Co., Morton Grove, Ill.* **171**

Bryant Gas Boiler-Burner

NAME—Bryant boiler-burner.

PURPOSE — Complete automatic burner assembly for gas firing boilers from 10 to 180 hp.

FEATURES—Only gas piping and electric wiring are needed to complete the installation of the new series BB boiler burners. Shipped as a complete package, the unit includes protective equipment and pressure controls and is suited to industrial or commercial applications. Main element of the burner is the Bryant Pow-R-Sembly which includes constant pressure blower, single or double burner nozzles each with compact proportional mixer, zero regulator, motorized air valve, electric ignition pilot, and manual reset safety gas valve. Steam pressure controls, or remote thermostatic control, or both, are furnished in the packaged unit. The burners operate automatically over three steps of heat output. For light loads, the pilot functions, while the main burner automatically takes over at low fire or full fire as required. Burners are supplied with valves sized for manufactured and mixed gas, or for natural and LP gas. Square flange connections are said to make possible a flexible arrangement of ele-



ments to suit installation space available.

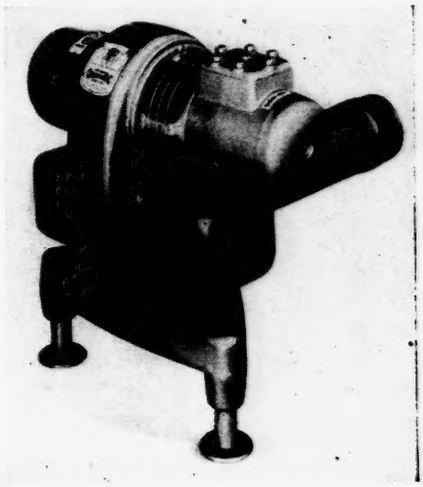
MADE BY—*Bryant Industrial Div., Affiliated Gas Equipment, Inc., 1020 London Rd., Cleveland 10, Ohio.* **172**

Fifty-Ten Oil Burner

NAME—Fifty-Ten Oil-O-Matic low pressure oil burner.

PURPOSE—Low pressure oil burner for house heating.

FEATURES—Highlights of this unit are a new hydraulic shut-off valve, new oil-air nozzle, capacitor start motor, and a new cushion coupling. The "sealed thrift unit" has, in one assembly, a built-in suction pump, a new metering pump, and a "pressurotor" for internal air supply. A wide variety of oil delivery adjustments can be made varying from two quarts to over three gallons per hour by means of an adjusting screw. This assembly also has a hydraulic shut-off valve which automatically seals off the oil supply to the nozzle before the burner stops so that there is a complete



oil purge at the nozzle to eliminate possible carbon formation. An exact air volume is provided for all firing rates, it is claimed, without changing static efficiency. Metering pump is of the opposed piston type and delivers oil in an almost continuous stream so that flame pulsation is virtually eliminated. Capacitor start motor operates at 3450 rpm. Makers claim that this new burner has 154 less parts than previous models and that the efficiency has been increased by 20% for average installation.

MADE BY—*Williams Oil-O-Matic Div., Eureka Williams Corporation, Bloomington, Ill.* **173**

Anti-Rust Paint

NAME—Rustrem.

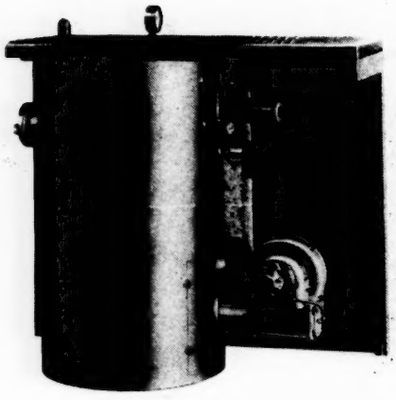
PURPOSE—Heavy duty aluminum anti-rust paint.

FEATURES—Paint untilizes an aluminum paste which is said to be brighter than those ordinarily employed. Paint can be applied over rust without wire brushing or scraping and is claimed to be suitable for interior and exterior use. It is provided in proper consistency for either brush or spray application.

MADE BY—*Speco, Inc., Cleveland 9, Ohio.* **174**

Delta Boiler-Burner

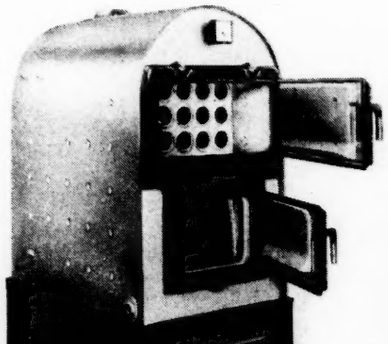
NAME—Delta boiler-burner unit model LA.
PURPOSE—Space heating.
FEATURES—Makers claim that low water content of boiler plus a high



heat transfer provides for rapid heating action. A large size copper tankless coil in the boiler provides domestic hot water. Finned construction of this coil is said to increase normal heating surface by 58%. Low water cut-off automatically shuts off the burner in the event of low water and starts the burner automatically when the boiler is refilled. Unit has a Delta oil burner. Jacket is lined with 1½-inch rockwool insulation.
SIZES AND CAPACITIES—Available in five models with oil firing rate varying from 1 to 3 gph, and providing from 96,000 to 264,000 Btu.
MADE BY—*Delta Heating Corp., 85-07 Northern Blvd., Jackson Heights, N. Y.* **175**

National Steel Boiler

NAME—National Radiator Company steel boiler.
PURPOSE—Residential space heating with steel boilers designed for hand firing.
FEATURES—Boilers feature a combination of double pass construction and numerous individual 3-inch diameter steel tubes. Resulting subdivision of hot gases and the wiping action of the rapidly ascending water in numerous passageways between the tubes is said to insure an effectve heat transfer. The large firebox provides high fuel capacity and space for complete combustion of fuels and gases. Firebox width and height conform with the recommendations of the Stoker Manufacturers Association. A true-arch crown sheet prevents sludge from depositing over the hottest part of the firebox crown. Upward flaring of water legs is said to provide a large volume of water adjacent to the hottest portion of the firebox. Precision ground cast iron doors are provided with heavy cast iron liners. Heat loss from this door is prevented by 2 inches of rockwool insulation between door and liner. Narrow width of boiler permits handling through normal size doors and passageways. Boilers are said to meet all requirements of the A.S.M.E. Code and are rated in accordance with the rating code of the Steel Boiler Institute. A jacket can be furnished if desired.
SIZES AND CAPACITIES—The 26-inch, 29-inch, and 39-inch steel boil-



ers are available in nine sizes with net ratings from 570 to 2,480 sq ft of steam radiation or 910 to 3,970 sq ft of hot water radiation.
MADE BY—*The National Radiator Co., Johnstown, Pa.* **176**

Maid-O'-Mist Strainer

NAME — Maid-O'-Mist pipeline strainer, No. 43.
PURPOSE—Strainer for use on water, air or gas lines.
FEATURES—A large screen area is said to assure an efficient removal of dirt and foreign matter without effecting any noticeable drop in line pressure. The 80-mesh monel woven wire screen is easily removed for cleaning. Unit is free from internal threads and is constructed of non-ferrous metal. Housing shell is heavy drawn brass with brass fittings brazed to the housing body. Gas or fluid enters the strainer through the ⅜-inch I.P. thread inlet at the side, passes through the screen and then flows out through the ⅜-inch I.P. thread outlet at the top of the strainer.

SIZES AND CAPACITIES—Besides the unit illustrated, two other sizes are available—model No. 44 with larger screen area for extra large sludge area; No. 47 for air or gas use only.
MADE BY—*Maid-O'-Mist, Inc., 3217 North Pulaski Road, Chicago 41, Ill.* **177**

Heating Calculator

NAME—Heating calculator.
PURPOSE—Slide rule for quick calculation of heating system problems.
FEATURES—Front of calculator is used to determine the Btu loss per hour and includes scales which involve dimensions of space considered, heat and air leakage factors, air changes per hour, and temperature differences. The back of the calculator shows the Btu loss per hour and gives direct readings, all at one time, of equivalent radiation for steam and hot water, cubic feet of air per minute required to supply the Btu hourly loss, and other data. Slide rule can be used to determine the required area of ducts and equivalent diameter when the cubic feet per minute and velocity in feet per minute are known. This rule has been out of production since the beginning of the war but is now available again.
MADE BY — *Calculator Specialties Co., 122 S. Michigan Ave., Chicago, Ill.* **178**

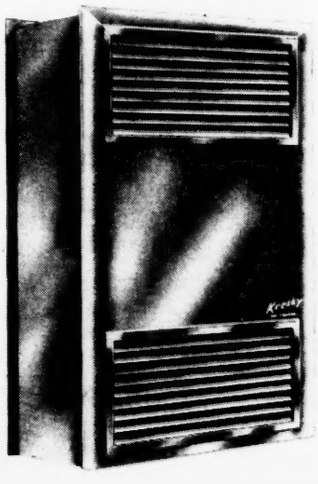
Knight Pump

NAME—Knight circulating pump.
PURPOSE — Pump for use with evaporative type of coolers.

FEATURES — Unit is constructed of heavy cast aluminum alloy and is operated by a fully enclosed 1/30 hp, 115-volt, 60-cycle, continuous duty motor. A built-in fan keeps the motor cool. All parts are machined and are said to be well balanced. Pump has a ½-inch copper tube outlet. The unit is provided with convenient mounting bolts.
SIZES AND CAPACITIES—210 gph at a head of 6 ft.
MADE BY—*Harry H. Knight Co., 2821 Live Oak St., Dallas, Tex.* **179**

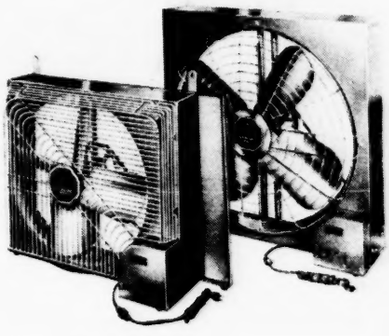
Kresky Wall Furnace

NAME — Kresky oil type wall furnace.
PURPOSE—Space heating by wall-installed unit.
FEATURES—On each exposed side of furnace there is an upper and lower louver. Cold air is drawn in through the bottom louver and warm air is discharged through the upper one. Top and sides of the furnace casing are completely insulated. Furnace is built to deliver heat to both sides of the wall to warm the entire home or the heat can be diverted to flow to only part of the house. The burner is of the forced air induction type. Flow of oil through the fuel line is controlled by a valve which regulates the amount of oil to meet requirements. When the burner is operated automatically, the valve keeps a slight trickle of oil feeding into the sump to maintain a pilot light. For a low fire the valve keeps the sump filled with oil, while for a medium fire valve keeps the medium fire pan in the bottom of the burner covered. For a high fire the entire bottom of the firebox is kept covered with fuel.
SIZES AND CAPACITIES—Heat output, 62,500 Btu capacity from a maximum fuel consumption of two quarts per hour. Furnace is 56½ inches high, 33⅝ inches wide, and 19½ inches deep.
MADE BY—*Kresky Mfg. Co., Petaluma, Calif.* **180**



Lau Window Fan

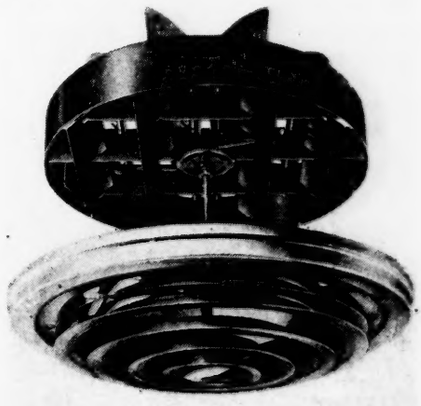
NAME—Niteair window fan.
PURPOSE—To draw in cool night air into the space to be cooled, or to serve as a daytime air circulator.



FEATURES—Unit is designed to fit inside any window space. A switch is built into the plug-in cord. Rear guard of unit is made of chrome steel. The side spacer, which is standard equipment on the W-24 model, is available for windows up to 35 inches wide. An extra spacer for windows up to 40 inches wide may be obtained.
SIZES AND CAPACITIES—W-24 has a 24-inch aluminum blade fan which has a free delivery of 3,783 cfm. A 1/3 hp motor operates at 550 rpm. W-30 has a 30-inch aluminum fan with a free delivery rating of 5,745 cfm.
MADE BY—*The Lau Blower Co., Dayton 7, Ohio.* **181**

Tuttle & Bailey Diffuser

NAME — Aerofuse ceiling diffuser, type EAC.
PURPOSE—Air distribution.
FEATURES—Unit is designed to block the outer passage of the diffuser, either partially or completely. Manually operated by a lever, the auxiliary effective area control ring slides on an inclined plane and is raised or lowered to vary the effective area. Spring loaded clips hold the ring in any desired position. In the fully closed position the ring completely seals off the outer air passage reducing the effective area of the diffuser by about 40%. As the ring can be set at any position from fully closed to fully opened, the diffuser can be adjusted to supply the exact throw required and the correct air delivery. Diffuser may be installed either flush with the ceiling or on exposed ductwork. When installed on ceiling the deep outer ring temporarily holds the air stream away from the ceiling to minimize streakage. A sponge rubber gasket around the outer edge of the diffuser provides an air-tight seal making the installation leak-proof. A quick connector type fastener enables removal of entire section to facilitate maintenance.
LITERATURE AVAILABLE — Catalog 49A.
MADE BY—*Tuttle & Bailey, Inc., New Britain, Conn.* **182**



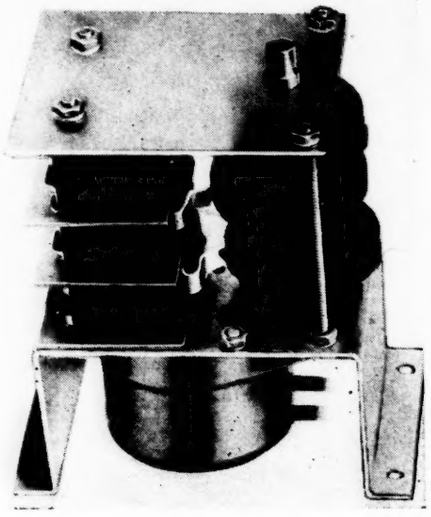
Infra Insulation

NAME—Infra accordion insulation.
PURPOSE—Reflective insulation for buildings.

FEATURES — Changes have been made in the design of this insulation to provide a stronger edge by which the accordion-pleated insulation may be stapled into place. Insulation consists of two aluminum sheets with a fiber separating medium. These aluminum sheets now come to the edge of the flanges so that the staples permanently pierce the two layers of aluminum as well as the fiber layer to supplement the adhesive that is used. In use, one flange is attached to a beam or other support. The other flange is then grasped with both hands and pulled so that the folds in the aluminum open up and the fiber layer between the aluminum sheets tends to separate the sheets to provide a number of partitioned air spaces. Improvement in the insulation is said to insure that the insulation will remain in place permanently for the life of the building, and also to provide an additional reflective air space.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Infra Insulation, Inc., 10 Murray Street, New York, N. Y.* **183**

Cramer Cycle Timer

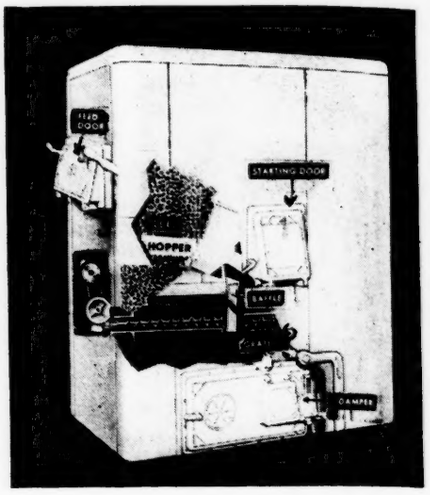
NAME—Cycle timer type CF3.
PURPOSE—To control automatically a 1-, 2-, 3- or 4-circuit operation in a predetermined timing sequence.
FEATURES—Unit, which is designed for built-in application, is used to regulate a series of operations in equipment. Timer consists of a synchronous motor mounted on a bracket. Single or multiple cams fastened to the motor shaft operate an enclosed dust-proof, snap-action switch. The motor, with enclosed gear train, is fully lubricated for long service.
SIZES AND CAPACITIES — Available in 27 time ranges, from one revolution in 10 sec to one revolution in 24 hr.
LITERATURE AVAILABLE — Bulletin 1520.



MADE BY—*The R. W. Cramer Co., Inc., Centerbrook, Conn.* **184**

Worsham Furnace

NAME—Worsham minute stokerette furnace.
PURPOSE — Home-heating furnace designed for automatic burning of high volatile coals, coke, smokeless fuels, and certain sizes of anthracite.
FEATURES—No. 8 boiler plate steel is used in construction of furnace and the combustion chamber is refractory lined. Ashes are deposited in a portable ash receptacle. A 24 to 96-hr supply of coal is placed in the hopper through the feed door. Coal is fed automatically to fire, as needed, by a water cooled screw conveyor operating in a U-shaped special type of grate. Ashes fall off at the end of the grate into the ash receiver. Where a larger size unit is installed in a small home, it can be adjusted through drafts for that home and will probably require attention once every two or three days. Blower unit inside of casing



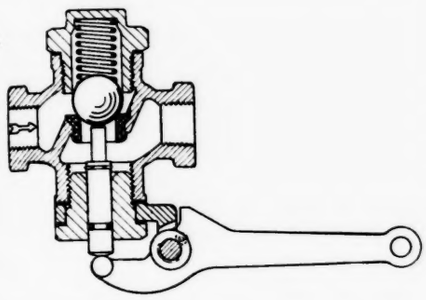
is also available equipped with filters.
SIZES AND CAPACITIES—Model A, for homes of three to nine rooms, supplies 40,000 to 120,000 Btu. Outside of casing measures 41 by 45 inches, and height of casing to bottom of canopy, 54 inches. Model B, for homes of nine to 12 rooms, supplies 40,000 to 200,000 Btu, measures 41 by 51 inches, and height of casing to bottom of canopy is 54 inches.
MADE BY — *Worsham Company, Inc., 7329 Lohmeyer Ave., St. Louis 17, Mo.* **185**

Pipe Label

NAME—Quik-Label pipe marker.
PURPOSE — For identifying pipe content.
FEATURES—Labels are produced as markers with colors that are in accordance with the ASA standard for identification of piping systems. Labels are printed on cloth strips with adhesive backing and are affixed to paper which can be peeled off when the label is to be used. A silicone plastic coating is said to make the labels waterproof and impervious to dirt. Each label marker is 2¼ x 9 inches. A wide variety of labels for various types of services is available.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*W. H. Brady Co., Dept. 4, 815 N. 3rd St., Milwaukee 3, Wis.* **186**

Leslie Valve

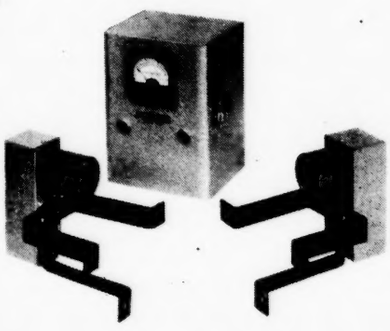
NAME—Type BA-1 self-sealing ball type valve.
PURPOSE—Self-sealing air or water operating valve with quick-opening lever.
FEATURES—Valve closes tight with



inlet pressure and is provided with a quick-opening lever that may be adjusted to any horizontal position. Stem is sealed by an "O" ring which eliminates a stuffing-box. It is constructed with a cast semi-steel body, has integral rubber seat insert, screwed connections, and can be bushed, ½ inch size, to ¼ or ⅜ inch. Valve is suitable for use with air, water, and other fluids of a non-corrosive nature up to 200 lb per sq in. pressure, and temperatures up to 150F for air and 180F for water.
MADE BY—*Leslie Company, 52 Delafield Ave., Lyndhurst, N.J.* **187**

De-Tec-Tronic Smoke Alarm

NAME—Economy smoke alarm.
PURPOSE — A photoelectric means of indicating density of smoke passing through flue of the boiler; to start signals when density of the smoke exceeds a predetermined amount.
FEATURES—Photo cell and light source housings are mounted on



opposite sides of breeching on rigid brackets. The light source projects a beam through an opening in the breeching to an opening in the opposite side where the photoelectric cell is mounted. These two units are connected to the amplifier control which can be placed near other controls to facilitate adjustment and supervision. Control may be set for any predetermined density of smoke. Indicating meter and lights on the front of the control cabinet indicate the amount of smoke passing through the breeching. Lights show green for clear stack and red when smoke is passing through the breeching. A signal bell or lamp signals when too much smoke is passing through. The photoelectric amplifier has a 3 sec delaying action to permit smoke to pass through to the stack for a period of 3 sec before a signal is given and it will hold this signal for 3 sec after the smoke has cleared from the stack. This delaying action is used to prevent false alarms due to short puffs of smoke or to line surges.
MADE BY—*De-Tec-Tronic Laboratories, Inc., 1227 N. Clark St., Chicago 10, Ill.* **188**

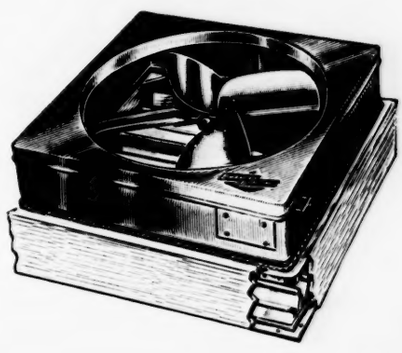
Electrol Oil Burner

NAME—Electrol oil burner, model TMJ.
PURPOSE—Space heating for factories, schools and large apartments using light fuel oil.
FEATURES — Pump and pressure regulator valve assembly are designed for high capacity burners. The pump is made of nickel cast iron. Pressure regulator is a simple diaphragm type using stainless steel discs as a regulating medium. The heavy motor and fan revolves for some time after electric current is shut off. Therefore, to provide against the possibility of oil being sprayed into the combustion chamber by this coasting effect, a heavy duty magnetic oil valve is used that snaps shut the instant the electric circuit is broken. Motor and blower unit is provided with a heavy duty motor operating at 1725 rpm and rated at 1/3 hp. Two stainless steel atomizing nozzles are supplied.
SIZES AND CAPACITIES — 2400 to 5000 sq ft E.D.R. for steam, and 3800 to 8000 sq ft E.D.R. for hot water.
MADE BY—*Electrol Burner Manu-*

facturing Co., Inc., Rutherford, N. J. **189**

Emerson Attic Fan

NAME — Emerson vertical discharge attic fan.
PURPOSE—For house cooling and ventilation.
FEATURES — Installation requires only a ceiling opening 12 inches wide. Four corner brackets are supplied for mounting the fan in the framing. Rubber feet on the corners of the fan insulate the fan housing from the corner supports. Rubber stripping is mounted on the fan housing to provide insulation from the framed ceiling opening. Fan is powered by a ¼ hp ball-bearing, split-phase motor equipped with an automatic thermal protector. A ball bearing between the fan hub and pillow block carries the thrust load of the fan.
SIZES AND CAPACITIES—6500 cfm.
MADE BY — *The Emerson Electric Manufacturing Co., St. Louis 21, Mo.* **190**



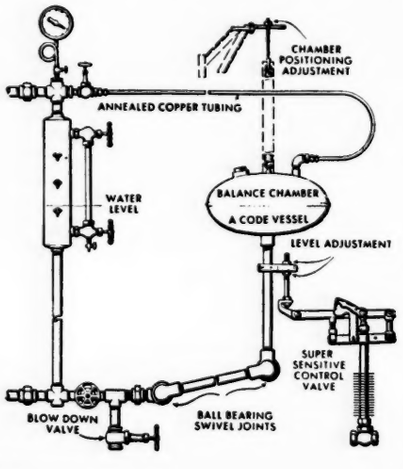
Skidmore Sump Pump

NAME—Skidmore sump pump.
PURPOSE—For general use where seepage makes drainage necessary, or for use in boiler rooms and commercial installations.

FEATURES — The ¼ hp motor has built-in overload protection. The pump screen has an area 12 times the suctional opening to prevent clogging. Pump is of all-bronze construction with copper float and stainless steel shaft so that, it is claimed, cavitation and corrosion are eliminated.
SIZES AND CAPACITIES—3000 gph at 5-ft head, 2500 gph at 10-ft head, and 2100 gph at 15-ft head.
MADE BY—*Skidmore Corporation, St. Joseph, Mich.* **191**

Liquid Level Control

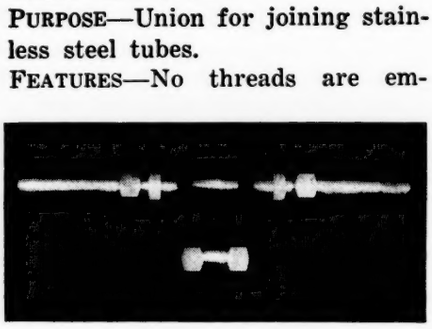
NAME—Weight-O-Water.
PURPOSE—Boiler feed water control.
FEATURES — Controller embodies the use of an ellipsoidal balance chamber and a code vessel, 18 in. in diameter, which is hung on a spring to permit its rising and lowering. At the top of this chamber an annealed copper tube is connected with the water column piping of the boiler. This chamber is connected to the bottom of the boiler's water column. Equalization of levels between the chamber and boiler is provided. Should the water level rise ⅛ inch in the boiler it also rises ⅛ inch in the chamber. The up and down movement of the chamber actuates a control valve which controls the amount of water fed to the boiler. Instead of a stuffing gland the valve has an 8-inch Neoprene stem seal. Fins on bonnet extension of valve dissipate heat to provide a long life for the seal.



OPERATION—A drop of level in the boiler causes the water to flow from the chamber back into the boiler. This lightens the weight of the chamber and since the chamber is suspended on a spring, the chamber rises to open the valve so that water may be fed into the boiler. As the water level rises, flow from boiler to chamber increases the weight of the chamber so that the valve starts to close.
MADE BY—*J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach 7, Calif.* **192**

Sta-Union

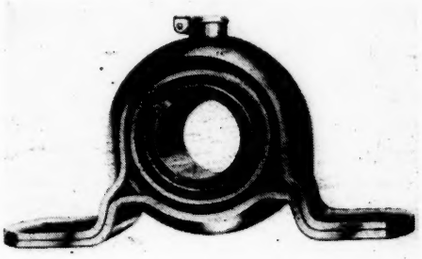
NAME—Sta-Union.
PURPOSE—Union for joining stainless steel tubes.
FEATURES—No threads are employed on the steel tubes in making the joint. The body of the union is stainless steel to provide corrosion resistant joints. The standard grip nuts are of mild steel unless stainless steel is specified. Gaskets are of a special plastic that is resistant to heat up to 400F, and is said to be capable of resisting the attacks of acid and strong alkalis. In making the joint all burrs are removed from the ends of tubing and then cleaned to eliminate grease. The operator then screws back the grip nuts which are slipped over the tube ends—locating the joint at about the center of the union. The grip nuts are then tightened uniformly and a tight joint is thus provided. Fitting can be used for pressures up to 150 lb per sq in.



SIZES AND CAPACITIES—In sizes of ¾, 1, 1¼, 1½, 1⅞ and 2¼ inches.
MADE BY—*Steel Products Corporation, 52 Vanderbilt Ave., New York 17, N. Y.* **193**

Triangle Pillow Block

NAME—Triangle pillow block.
PURPOSE—Pillow block for light machinery shafting.
FEATURES—The built-in, synthetic rubber cushions, with static eliminator, are oil-proof and absorb vibration. A porous bronze bushing, wick-fed from an oil chamber, is said to insure long time lubrication without attention. Wide range self-alignment is provided by a ball and socket action. All metal parts are heavy gage steel stampings. Special mountings are designed to meet individual conditions.



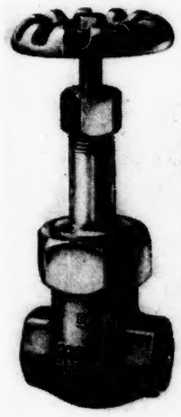
LITERATURE AVAILABLE—Illustrated bulletin.
MADE BY—*Triangle Manufacturing Co., Oshkosh, Wis.* **194**

Fuel Oil Treatment

NAME—Nalco SR-155.
PURPOSE—To prevent sludge formation in oil storage tanks and to eliminate fouling of fuel oil preheaters and the formation of gum at burner tips.
FEATURES—Compound is added to the fuel oil in the storage tank and requires no special feeding equipment. It has been tested in power plants.
MADE BY—*National Aluminate Corp., 6278 W. 66th Pl., Chicago 38, Ill.* **195**

Cooper Stainless Steel Valve

NAME—Union bonnet gate valve.
PURPOSE—Stainless steel valve for use where corrosion resistance is required.



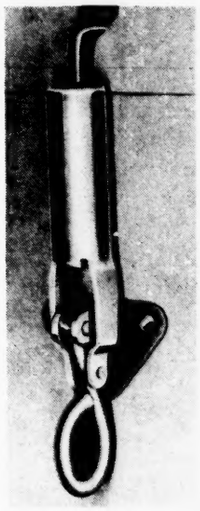
FEATURES—Union bonnet design is said to provide long service life and simplified maintenance. Ball and socket point contact discs adjust themselves in any position. A minimum of six turns of packing is used to insure effective sealing. Available in various stainless steel alloys.
SIZES AND CAPACITIES—½, ¾ and 1 inch.
MADE BY—*The Cooper Alloy Foundry Co., Hillside, N. J.* **196**

Westinghouse Insulation

NAME—Westinghouse plastic foam.
PURPOSE—Insulating material.
FEATURES—Foam is made by heating a molasses-like synthetic resin at about 350F until it expands to 100 times its original volume and then solidifies. Thousands of gas bubbles are entrapped in the foam to provide lightness to the plastic. Liquid can be shipped in a barrel and then foamed into place wherever needed. Insulation contains about one part of resin to about 100 parts of air. A 2-inch thick layer of this material weighing only 300 lb is said to be sufficient to insulate a complete six-room house and this amount could be made from a 35-gal barrel of the liquid resin. Lump illustrated weighs 8 lb.
MADE BY—*Westinghouse Electric Corp., Pittsburgh 30, Pa.* **197**

Donaldson Hood Fastener

NAME—Donaldson hood latch.
PURPOSE—Spring-loaded hood fastener for holding sheet metal flaps and panels tightly closed.



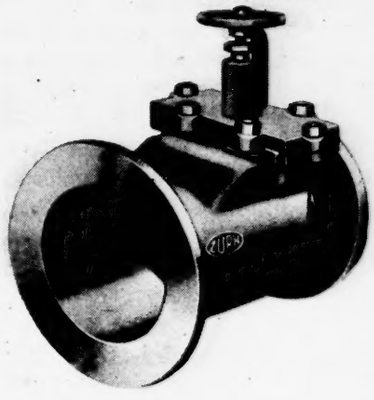
FEATURES—Three rivets hold the fastener in place. A hole drilled through the metal panel to be secured accommodates a bolt unit. To close, the handle of the spring fastener is pushed down and the bolt locks against the rim of the hole. The latch has a take-up of 7/16 inch and retains, in the closed postion, about 40 to 50 lb tension.
MADE BY—*Donaldson Co., Inc., 666 Pelham Boulevard, St. Paul 4, Minn.* **198**

Shell Rust-Proofing

NAME—VPI.
PURPOSE—A vapor phase inhibitor for preventing rust on metal objects.
FEATURES—Kraft paper is coated on one side with a special chemical termed VPI. After a metal article has been wrapped in this paper, the chemical slowly vaporizes inside the package to neutralize the corrosive action of moisture in the air. Several types of prefabricated packages may be made with VPI coated stock such as corrugated cartons, envelopes and bags. Depending on the tightness of the wrapping, the makers claim that complete surface protection is provided for periods ranging from one month to more than five years. For average use, in which protection is needed for less than two years, simple fold closures of the paper secured by string or gummed tape have proven adequate. VPI paper is now being produced by three manufacturers under license from the Shell Development Company and is for sale only in commercial quantities.
MADE BY—*Shell Development Co., 50 W. 50th Street, New York 20, N. Y.* **199**

Zurn Check Valve

NAME—Zurn discharge check valve.
PURPOSE—To regulate flow so as to protect against back flow and fouling of pumps and equipment.
FEATURES—Valve has a swing check flap suspended from a full floating pin fulcrum to insure positive full surface contact between ground face of flap and flap seat. Knob in the center of the top surface of the swing check flap contacts the valve body roof at only one point when the flap is wide open. This is said to provide for free operation of the swing check flap. This flap can be replaced and removed easly. Valve may be operated with or without a manual control or with an extension shaft or flexible cable from an access box. Units are available with 180 deg, 150 deg, or 90 deg bodies, and are made of cast bronze, steel, semi-steel, cast iron and alloy metals.
MADE BY—*J. A. Zurn Mfg. Co., Dept. Z-8, Erie, Pa.* **200**

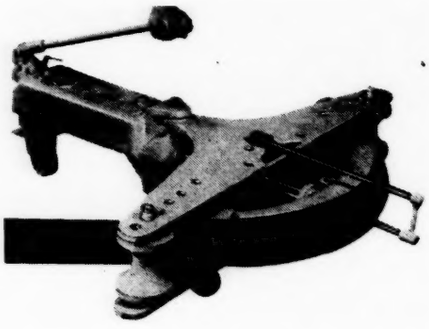


Radiant Heating Panel

NAME—Solarheet.
PURPOSE — Radiant heat through electrically operated ceiling panel.
FEATURES — Panels are made by sandwiching a heating element between two layers of wallboard. Completed thickness is ½ inch to match ½-inch gypsum board that is recommended for use in covering unheated areas of the ceiling. Panel is recommended for ceiling installations only and for ceilings up to 9.5 ft in height. Panels have 25 watts rating to each sq ft of surface. Other capacities can be adjusted in design. Room heating requires 1¼ watts per cu ft for interior rooms and 1½ watts per cu ft for corner rooms. For zones where there are more than 4,500 degree-days in a heating season, add ½ watt per cu ft to each of these figures. Panels should be placed on the perimeter of the room, particularly for outside walls. Makers claim that panels will operate indefinitely at four times their rated voltage without damage to the element. The element is said to have an indefinite life under normal operating conditions; that before it can burn out, the element will have to get 15 times as hot as its operating temperature. Paint, wallpaper or canvas may be used on the surface of the panel where additional treatment is required. Each panel, which has a nailing area correctly marked, is designed for 16- or 24-inch spacing of joists. Panels can be placed parallel or at right angles to these joists. All panels are heat treated and sealed before shipment.
SIZES AND CAPACITIES—Panels are available in sizes of 4 x 8 ft, 4 x 5 ft, and 3 x 4 ft with capacities, respectively, of 800, 600 and 350 watts.
MADE BY—*Homes, Inc., Box 1167, Knoxville, Tenn.* 201

Tal Pipe Bender

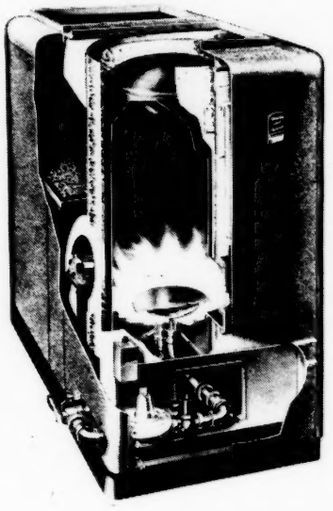
NAME—Tal 4-inch portable hydraulic pipe bender.
PURPOSE—For bending regular or extra heavy pipe from ⅜ to 4 inches.
FEATURES—A bend indicator on the machine shows the degree of bend that is being made. Makers claim that a smooth bend, free from distortion, can be made in a single setting. It is said that 15 min are required to make 90-deg bends with 4-inch pipe. Change-



over from one pipe size to another is said to be made without difficulty. Machine is mounted on casters and can be set up for on-the-spot work.
LITERATURE AVAILABLE—Bulletin.
MADE BY—*Tal Bender, Inc., Milwaukee, Wis.* 202

Timken Gas Furnace

NAME—Timken silent automatic winter air conditioning gas furnace.
PURPOSE—Space heating for small and medium sized homes.
FEATURES—Unit is provided with an automatic gas burner, furnace and radiator assembly, blower, filters and automatic humidifier. Furnace proper is all welded and made of 12-gage hot-rolled steel. Radiator is of the pre-heat type to step up temperature of return air before it is passed into the furnace compartment. Burner produces a sunburst flame to blanket the heat absorbing surface. Air supply is adjustable to permit regulating primary air in accordance with requirements of type of gas used. Bunsen-type pilot has thermo-electric device to shut off the gas supply in the event of pilot flame failure. Pan-type humidifier may be installed in plenum chamber directly above furnace. Filters are of the spun glass replaceable type. A multivane double inlet type blower is used with the motor mounted on rubber to reduce vibration.
SIZES AND CAPACITIES—Output at plenum of 60,000, 80,000, and 107,000 Btu. Air delivery varies from 480 to 1,200 cfm at 1/8-inch static pressure, depending on size



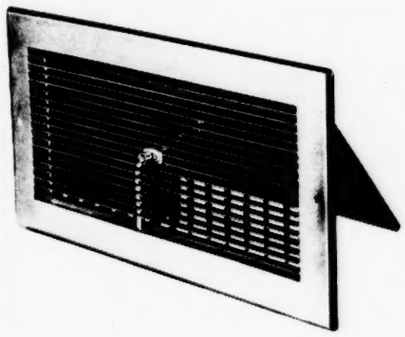
of unit. Blower motor is 1/6 or ¼ hp, depending on size of unit.
MADE BY—*Timken Silent Automatic Div., The Timken-Detroit Axle Co., Jackson, Mich.* 203

Louis Allis Motor

NAME—Louis Allis Company single phase motor.
PURPOSE—For general motor use.
FEATURES—A new approach was used in the design of a line of single phase motors. The centrifugal switch formerly used to disconnect the starting condensers from the line after the motor comes up to speed has been replaced by a voltage relay. This relay is mounted in the control cabinet that is supplied with the motor. Cabinet also includes an across-the-line starter and the necessary capacitors which make possible the removal of the capacitor enclosure on the motor itself. Capacitor run types are supplied with oil type running capacitors which are also mounted in the control cabinet. This new motor line is available in open drip-proof, splash-proof, totally enclosed, fan cooled, and explosion-proof construction.
SIZES AND CAPACITIES — Capacitor start-induction run type 1 and 1.5 hp; capacitor start-capacitor run type, 2, 3, 5, 7.5 and 10 hp.
MADE BY—*The Louis Allis Co., Milwaukee, Wis.* 204

Lima Register

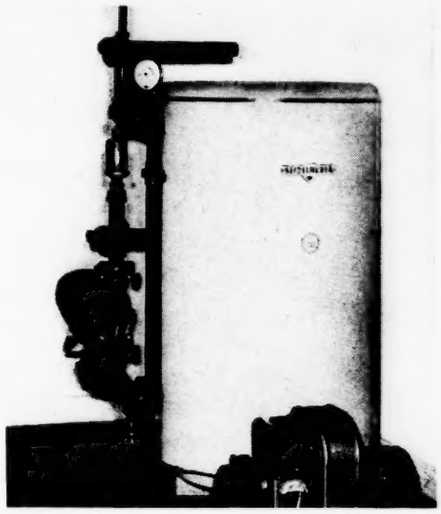
NAME—Lima register.
PURPOSE—Control of air discharge.
FEATURES—Horizontal louvers are installed across the face of the



register. Air diffusion is designed to provide maximum comfort. Diffusing blades diffuse air laterally both ways and enclose an angle of about 60 deg. Blades can be bent from the face of the register to provide any desired diffusion pattern. Air discharge is always held horizontal. There is no adjustment on the unit to control air travel up or down. A spring-loaded valve, controlled by a ball chain, regulates the amount of air delivered so that the register can provide balanced temperatures in every room where this register is installed. It is claimed that there is no whistling either when the valve is opened or shut.
SIZES AND CAPACITIES—Available in three sizes, 10 x 6, 12 x 6, and 14 x 6 inches, for wall or baseboard installation.
MADE BY—*Lima Register Co., Lima, Ohio.* 205

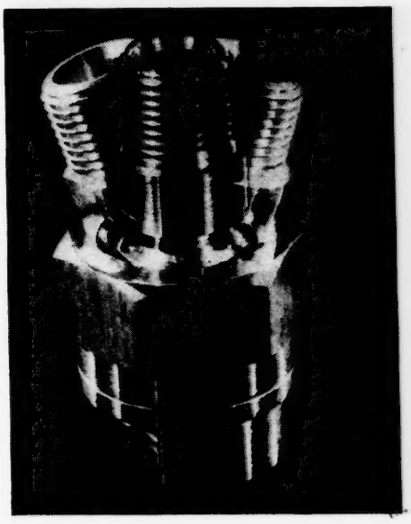
Oil-Fired Furnace Boiler

NAME—Seidelhuber oil-fired furnace boiler.
PURPOSE—Oil-fired flash boiler designed for radiant heating systems in residences.
FEATURES—Standard steel 1¼-inch diameter pipe is used for the construction of the coil in the boiler. The burner flame and heat travel up the center of the coil and the heat then moves down the outside so that 50% more heating surface is exposed. The fire brick is already installed by the factory. Top of boiler is easily removed for service work and cleaning. Only two connections need be touched to remove the coil. A stainless steel shield is placed over the fire brick to protect the lower pipe coils from intense heat near the burner. Stack opening is at the bottom and rear; stack temperature is as low as 400F. A complete installation requires only 15 sq ft floor area. Company supplies the boiler only — pumps, burner, and controls must be furnished by contractor.
SIZES AND CAPACITIES—Unit to be produced in three sizes.
MADE BY—*Seidelhuber Iron & Bronze Works, Inc., 1421 Dearborn St., Seattle 44, Wash.* 206



Kelite Swivel Ball Coupling

NAME—Kelite swivel ball joint.
PURPOSE—A ball type joint coupling to permit motion in any direction without restriction of flow.
FEATURES—Leakage and drip are said to be eliminated by the use of



the "O" ring principle which provides a positive seal against leakage at any pressure. As the pressure increases, the seal becomes tighter although free movement is still maintained. Models for any size pipe and pressures and temperatures are available. Joint will turn 20 deg in any direction with no restriction of flow.
SIZES AND CAPACITIES—Standard ⅜-inch joint is good for pressures up to 150 lb per sq in., and for temperatures up to 350F.
MADE BY—*Kelite Products, Inc., Box 2917, Terminal Annex, Los Angeles 54, Calif.* 207

MAY, 1949

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below, circle the item number of the equipment in which you are interested, using the number found at the end of each item.

164	165	166	167	168	169	170	171	172
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182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199
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Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

HANDBOOK OF REFRIGERATING ENGINEERING

Within a relatively short period, refrigeration has developed from a little used luxury to an everyday necessity. A great deal has taken place not only in the field of application but also in design. New refrigerants have proved serious competitors of the time-tried ammonia, carbon dioxide and sulfur dioxide refrigerants. The absorption system which had lost popularity to the electrically driven piston compressor is now regaining prestige in many applicatons.

Engineering principles and applications to keep the engineer abreast of the rapidly developing field of refrigeration are very well presented in this handbook by W. R. Woolrich, Dean of Engineering, University of Texas, and Luis H. Bartlett, Director, Engineering Experiment Station, Louisiana State University. The third edition of this well known book is now available.

It contains an extensive section of 223 pages in which are included primary refrigerant charts and tables of thermodynamic characteristics of the various refrigerants.

Other divisions of the book cover the various types of compressors; condensers; refrigeration cycles; absorption refrigeration; secondary refrigeration; heat transfer; power drives and economics; testing of the refrigerating plant; instruments and controls; atmospheric water cooling; filters and water softeners; ice and ice making; cold storage; refrigeration applied to air cooling; marine refrigeration; lubrication; fans; pumps and injectors; piping and tubing data; and a number of chapters that apply to food freezing and preservation.

Handbook of Refrigerating Engineering, by W. R. Woolrich and L. H. Bartlett. Flexible fabric cover, 5 x 7¼ in., 730 pages. Published by D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, N. Y. Price, $8.50.

INVENTION RECORDS

The grave necessity of adequate records in connection with patent claims was brought out as the result of the author's wide experience as a patent counsel. Harry A. Toulmin, Jr., of Toulmin and Toulmin, has prepared a small book containing sound help to those interested in protecting their patent rights.

The maintenance of adequate records has been successful in avoiding extensive litigation. This has been proven over many years. When prior right of a party can be produced in court, unnecessary legal disputes can be avoided.

In the first part of the book, Mr. Toulmin discusses the general nature of industrial property and monopolies granted to protect it. The second part of the book presents a practical method of insuring this recording of dates, and gives samples of suitable record forms. A chapter describes methods of patent investigations.

How to Keep Invention Records, by Harry A. Toulmin, Jr. Cloth bound, 5 x 7¾ in., 78 pages. Published by Research Press, Inc., Dayton, Ohio. Price, $2.50.

PATENT LAW

Of considerable interest to those having dealings with patent law and the protection of patent rights is the second edition of Patent Law, by Chester H. Biesterfeld. The author received a BS in Chemical Engineering from the University of Michigan and law degrees from Georgetown University. He has had considerable experience as examiner in the U. S. Patent Office and is at present employed as head of the patent department at E. I. duPont de Nemours & Co., Inc.

There have been a number of extensive revisions of the material originally presented. The material has been designed to afford the general reader a simple understandable treatment of each of the principal steps of the substantive law, supported by citations and quotations taken from court decisions. A careful selection has been made of decisions to support the principles of the law cited.

The reader may form the impression that the courts have been rather strict in dealing with patent statutes. However, the author does not believe that the federal courts have been too strict. From the decisions given it will soon be evident that the courts still try to protect the inventor when he presents in his patent a meritorious discovery or invention.

The material has been developed into 21 chapters and some of the subjects covered are: invention and discovery, novelty, priority of invention, originality, abandonment, permissible breadth of chemical claims, functional claims, unpatentability of use and products of nature, double patenting, reissues, disclaimers, the patent application and prosecution thereof, interferences, infringement, liability for infringement, licenses, ownership and shop rights, trade secrets, patent litigation, and searches.

Patent Law, by C. H. Biesterfeld. Cloth bound, 6 x 9 in., 267 pages. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $4.00.

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VENTING DIRECT GAS HEATERS.—The Engineering Experiment Station, Purdue University, issued a report on Research in Venting Direct Gas Heaters When No Chimney Connections Are Available (Report

No. 2). This is the second of a series on research conducted at the University for the American Gas Association on the problem of venting. Objectives of this research are to study current venting practice; study performance characteristics of vents; study commercial vent caps; study the depth of the static pressure region surrounding model houses; develop new methods and improve on present methods for the venting of gas appliances. The report presents results of research conducted on performance characteristics of vents and the study of the depth of static pressure regions surrounding model houses. This 66-page report by S. C. Hite, research associate and J. L. Bray, professor of metallurgical engineering, is available by writing to the Engineering Experiment Station, Purdue University, Lafayette, Ind.

AIR CONDITIONING CONFERENCE.—Bulletin No. 10 issued by the Texas Engineering Experiment Station contains the proceedings of the Fourth Annual Air Conditioning Conference that was held at the A & M College of Texas, College Station, Texas. This bulletin of 152 pages contains fifteen talks that were presented at this conference on air conditioning and refrigeration problems. Texas Engineering Experiment Station, College Station, Texas.

CORROSION OF PRESSURE VESSELS.—A 45-page bulletin issued by the American Society for Testing Materials contains papers on Station Design and Material Composition as Factors in Boiler Corrosion, by R. B. Donworth, Duquesne Light Co., and Corrosion of High Pressure Steam Generators: Status of Our Knowledge of the Effect of Copper and Iron Oxide Deposits in Steam Generating Tubes, by Richard C. Corey, Combustion Research Section, Bureau of Mines, Pittsburgh, Pa. These papers are part of a symposium presented at the fifty-first annual meeting of the Society that was sponsored by Committee D-19 on Industrial Water and the Joint Research Committee on Boiler Feedwater Studies. The papers and the discussion presented consider the effect on corrosion of the deposition as sludges or as metals, of non-ferrous metals and their compounds in pressure vessels. Price, for the bulletin described, $1.00 per copy. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

FUEL BURNING EQUIPMENT INSTALLATIONS.—The second edition of the statistical report issued by the Stoker Manufacturers Association on fuel-burning equipment installations in various cities for years 1948, 1947, and 1946 is now available. The report that was originally prepared and published in February, 1948, based on 1947 fuel burning installations proved to be so popular that a second edition has been made available to include data for 1948. The factual presentation for the years mentioned is designed to be of help to companies in the stoker industry, coal industry, and allied organizations. Price, 25 cents. Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1, Illinois.

HOME HUMIDITY CONTROL.—This is a progress report of work completed through June 30, 1948, in research on home humidity control. The objective of the research project was to determine the various sources of water vapor within a home, the amount of vapor from each source, the relative importance of each source and the possible methods of moisture control. The living habits of an average American family of four were used as a basis of all test work. This report is the first of a series on research conducted by Purdue University for the American Gas Association on the problem of home humidity control. Study was conducted by S. C. Hite, research associate, and J. L. Bray, professor of metallurgical engineering. For a copy of this 51-page bulletin on research in home humidity control, a request should be made to the Engineering Experiment Station, Purdue University, Lafayette, Ind.

OCCUPATIONAL OUTLOOK HANDBOOK.—The Bureau of Labor Statistics of the U. S. Department of Labor has prepared a 454-page illustrated book for the Veterans Administration that analyzes the employment prospects for skilled workers in the construction field. Each of the various trades is considered and predictions made as to employment possibilities in the coming years. The trades covered include carpenters, bricklayers, construction electricians, paperhangers, plumbers and pipe fitters, plasterers, sheet metal workers, structural and ornamental metal workers, construction machinery operators, and glaziers. Despite retarding effects of high costs, it is predicted that strong demands of construction will lead to a new high employment level for the next several years unless there is a marked general business decline. Price, $1.75 per copy. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

PRACTICE RECOMMENDATION FOR PIPES, DUCTS, AND FITTINGS.—The Commodity Standards Division of the National Bureau of Standards has a revised standard R207-49 covering pipes, ducts, and fittings for warm air heating and air conditioning that has been approved for promulgation. The recommendation which was originally issued in 1945 established a stock list of pipes, ducts, and fittings for both gravity and forced air heating and air conditioning that has been apadds sketches and dimensions for four types of take-off fittings for extended plenum systems. Commodity Standards Division, National Bureau of Standards, Washington 25, D. C.

STUDY OF BUNGALOW HEATING.—A comprehensive investigation of the heating characteristics of space heaters (heating stoves) for home heating in the United States was made by the National Bureau of Standards using a four-room test bungalow that was enclosed in an insulated shell to simulate different climates. A report on the performance of the heaters under various conditions is presented in a 44-page booklet "Temperatures in a Test Bungalow with Some Radiant and Jacketed Space Heaters." Tests were made in the bungalow to show the effect on interior temperatures of such factors as heater location, size and type of jackets, open transoms over interior doorways, unattached fans, and underfloor plenums. For a copy at 25 cents, write to Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

NEWS OF THE MONTH

INDUSTRIAL HEALTH

takes the spotlight in Detroit as five national groups hold concurrent meetings.

Five national organizations concerned with promotion of health and productivity of the Nation's labor force held their concurrent and interlocking annual meetings in Detroit during the week beginning April 1. A record registration of over 1200 delegates used facilities of three hotels, the Statler, Book-Cadillac, and Detroit-Leland, while 70 manufacturers and service organizations participated with technical exhibits.

Meetings were: 34th annual meeting, American Association of Industrial Physicians and Surgeons; 10th annual meeting, American Industrial Hygiene Association; 11th annual meeting, American Conference of Governmental Industrial Hygienists; 7th annual meeting, American Association of Industrial Nurses; 6th annual meeting, American Association of Industrial Dentists. Also present for two separate week-end conferences was a group representing industrial hygiene personnel of the U. S. Navy.

Of primary interest to engineers concerned with industrial environment control were technical papers, discussions, and committee reports of ACGIH and AIHA.

• **ACGIH.**—The American Conference of Governmental Industrial Hygienists, after a preliminary executive dinner meeting on April 1, got formally under way with a series of round table discussions over the week-end with chemists, engineers, nurses, and physicians holding separate conferences preliminary to a combined seminar and open forum reviewing problems of all groups. Monitoring these discussions were: for chemists, Dr. H. H. Schrenk, U. S. Public Health Services, and Dr. R. E. Moser, Oregon Board of Health; for engineers, C. D. Yaffe, U.S.P.H.S., and J. C. Soet, Michigan Department of Health; for nurses, F. Ruth Kahl, U.S.P.H.S., and Veronica Donnelly, New York State Labor Department; for physicians, Dr. Harry Heimann, U.S.P.H.S., and Dr. L. W. Spolyar, Indiana State Board of Health. Dr. K. E. Markuson, chairman-elect of the association, was general chairman of the seminar.

K. E. Markuson

• **TECHNICAL.**—Papers on the program of the governmental group included several of interest to ventilation engineers. Among these were: Health hazards associated with agricultural chemicals, by Dr. H. H. Abrams, California Department of Public Health; health of workers exposed to galena, by Louis F. Garber, Department of Public Health and Welfare of Missouri; aldehydes in diesel engine exhaust gas, by E. B. Berger, U. S. Bureau of Mines; the role of industrial hygiene agencies in air pollution control, by H. G. Dyktor, Cleveland Department of Public Health and Welfare.

Windup of sessions for the governmental groups included committee reports on ventilation by K. M. Morse, codes by C. D. Yaffe, threshold limits by Dr. L. T. Fairhall, dust counting by Dr. W. G. Frederick, etc. Dr. Fairhall's report included the following table of suggestions regarding threshold limit values:

1—New Threshold Limit Value

A value for ortho-dinitro-cresol of 0.2 milligram per cubic meter of air has been suggested on the basis of plant experience with this substance.

2—Proposed New Substances for Which No Threshold Limit Value Has Been Established

Asphalt fumes and dust	Ketene
Beryllium	Monochloromono-bromomethane
DDD	Pentachlorophenol
DDT	Propylene glycol
Ethylene glycol	Triethylene glycol
Diethylene glycol	
Dipropylene glycol	

3—Substances for Which Lower Threshold Limit Values Have Been Suggested by the Conference Members

Acetic acid	Hydrochloric acid
Acrolein	Naphtha (petroleum)
Alcohol, amyl	Nuisance dust
Alcohol, isoamyl	Ozone
Ammonia	Radiation, gamma
Benzene	Radiation, X-ray
Bromine	Silica
Carbon monoxide	Stoddard solvent
Carbon tetrachloride	Sulfuric acid
Hexavalent chromium	Trichloroethylene

• **OFFICERS.**— At a closing business session, the following officers of ACGIH were installed; Chairman Dr. K. E. Markuson, Bureau of Industrial Health, Michigan Department of Health; Chairman-Elect J. J. Bloomfield, U.S.P.H.S.; secretary - treasurer Dr. Louis Cralley, U.S.P.H.S. Dr. Markuson was also elected president of the Michigan Association of Industrial Physicians and Surgeons who met during the week of industrial health proceedings.

J. J. Bloomfield

• **AIHA.**—Proceedings of the American Industrial Hygiene Association included many papers and discussions with immediate engineering implications. Presiding at the opening session April 5, were E. C. Barnes, Westinghouse Electric Corp., president-elect of AIHA, and Dr. Leonard Greenburg of the New York Department of Labor. After his address of welcome, Dr. J. H. Sterner, Eastman Kodak Co., president of AIHA presented a paper covering a ten-year study

of butyl alcohol exposure. This paper was prepared by Dr. Sterner, H. C. Crouch, H. F. Brockmyre and M. Cusack, all of the Eastman Kodak Co., and described experience of the company in connection with carefully measured exposures at various stations in processes using large quantities of butyl alcohol.

• **INDUSTRIAL EXPOSURES.** — Other industrial exposures capable of response to engineered control were covered by a number of papers on the AIHA program.

X-ray studies of workers exposed to talc in the rubber industry, by W. L. Hogue, Jr., F. S. Mallette, Firestone Tire and Rubber Co., and E. von Haam, Ohio State University, discussed the various compounds of magnesium, silicon, calcium, etc., making up the powdered substances commonly known generically as talc with comments as to their expected physiological effect. A series of X-ray slides showed chest conditions among workers exposed to talc dusts.

E. C. Barnes

A preliminary study on glass worker's cataract, by Karl L. Dunn, Corning Glass Works, showed that there was no evidence of cataract resulting from exposures to intense radiant heat in the glass industry. Mr. Dunn presented some data on the extent and duration of exposures at eye level (as high as 4000 to 5000 Btu per (sq ft) (hr) in some cases) of workers with molten glass, and showed that the briefness of exposure and various control measures mitigated the probability of eye injury from radiant heat.

A comprehensive study of the health hazards in the ferrous foundry industry of Illinois is being undertaken by the United States Public Health Service. A preliminary report on the aims and scope of this study was presented by Lucian E. Renes, USPHS engineer. Worker exposure by occupation, in addition to other environmental factors such as dust particle size measurements, noise and illumination, are being studied. According to Mr. Renes, complete medical and dental examinations are augmenting the engineering and chemical phases of the work, all designed towards the prevention of occupational diseases in the ferrous foundry industries.

• **BERYLLIUM.**—Emphasis of the AIHA meeting this year was on beryllium, an element of increasing significance in manufacturing processes and one with startling and sometimes fatal effect in its contact with humans. A symposium of four papers treated various aspects of this metal as a threat to industrial health. These papers were: Acute experimental beryllium poisoning by inhalation exposures, by Dr. H. E. Stokinger and others of the atomic energy project at the University of Rochester; studies on the physiologic aspects of clinical berylliosis, by Dr. J. W. Howland and others of the University of Rochester School of Medicine; non-occupational berylliosis, by Merrill Eisenbud and others of the U. S. Atomic Energy Commission and cooperating bodies; Experimental production of lesions simulating pulmonary granulomatosis in beryllium workers, by Arthur J. Vorwald, The Saranac Laboratory.

• **AIR HANDLING.**—Three short papers covered problems of engineers concerned with air handling. The principle of the fog filter, by D. G. Hudson, Duncan-Hudson Co., described a recently developed principle of scrubbing gas or air with high pressure water fog in combination with a centrifuging process. Transport velocities for ducts, by Jack Baliff, Arthur C. Stern, and Dr. Leonard Greenburg, New York State Labor Department, presented a progress report on experimental studies now under way at the department. A third paper by Stanley C. Kyle, T.V.A., described continuous carbon monoxide recording and signalling instruments.

A. D. Brandt

J. H. Sterner

H. F. Smyth, Jr.

• **OFFICERS.**—Slate of officers of AIHA elected for the 1949-1950 term is: E. C. Barnes, Westinghouse Electric Corp., president; Dr. Allen D. Brandt, Bethlehem Steel Co., president-elect; Dr. J. H. Sterner, Eastman Kodak Co., past president; W. G. Hazard, Owens-Illinois Glass Co., secretary; and Charles Mehaffey, Mine Safety Appliances Co., treasurer. Permanent executive secretary of the organization is Dr. Henry F. Smyth, Jr., Mellon Institute of Industrial Research.

• **RADIATION.**—A joint meeting of all five groups was devoted to problems created by atomic radiation. The effects of radiation exposure, radiological safety, and catastrophy control were subjects of papers at this meeting.

M.A.C. STANDARD

for methyl chloride sets allowable concentration within limits of engineering control.

Engineering procedures now available can be used in putting into effect the new American Standard Allowable Concentration for Methyl Chloride, according to the American Standards Association which recently announced approval of the standard. This is the eighteenth in the series of national standards that define the amount of various toxic dusts and gases that can safely be permitted in the air of work places. The standards are being developed under the procedure of the American Standards Association by a committee of scientists and medical men with national reputations for work in improving industrial health conditions. William P. Yant, director of research,

Mine Safety Appliances Co., is chairman of the Sectional Committee on Allowable Concentrations of Toxic Dusts and Gases, Dr. C. D. Selby, medical consultant of the General Motors Corp. is vice-chairman, and Henry G. Lamb, safety engineer of the American Standards Association, is secretary. The Bureau of Mines, U. S. Department of the Interior, as endorsing sponsor, recommended approval of the methyl chloride standard.

• **USES.**—Widespread industrial use of methyl chloride as a catalyst solvent in the synthetic rubber industry, as an extractant for greases, oils, and resins, and as a dewaxing agent in the petroleum-refining industry, has emphasized the need for defining the safe concentration for this compound.

• **DANGERS.**—According to members of the committee, the principal danger lies in the possibility that repeated exposures to low concentrations of methyl chloride will result in dangerous absorption by inhalation rather than that acute poisoning may result from a single exposure to high concentrations. Symptoms that may be encountered are increasing fatigue, loss of appetite, drowsiness, muscular weakness, staggering gait, mental confusion, vertigo, visual disturbances, nausea, slurred speech, convulsions, and coma.

• **VALUES.**—Values suggested for the maximum allowable concentration of methyl chloride have ranged from 100 to 500 parts per million. After careful consideration of available toxicological data and experience in handling methyl chloride in industry, it was decided that: "The maximum allowable concentration of methyl chloride shall be 100 parts per 1,000,000 parts of air by volume corresponding to 0.2 milligram per liter at 25 C and 760 mm pressure, for prolonged exposures not exceeding a total of eight hours daily."

In order to prevent injurious exposures the concentration of methyl chloride in the breathing zone of exposed persons must be determined, and control measures put into effect where concentrations are found to be more than is permitted under the newly agreed upon allowable concentration.

• **PRACTICAL.**—"Past experience in handling methyl chloride in industry indicates that this standard is a practical one and can be met with engineering procedures that are now available," declares H. H. Schrenk, scientist director of the Division of Industrial Hygiene, U. S. Public Health Service, who was chairman of the subcommittee that developed the American Standard Allowable Concentration of Methyl Chloride, designated Z37.18—1949 by ASA.

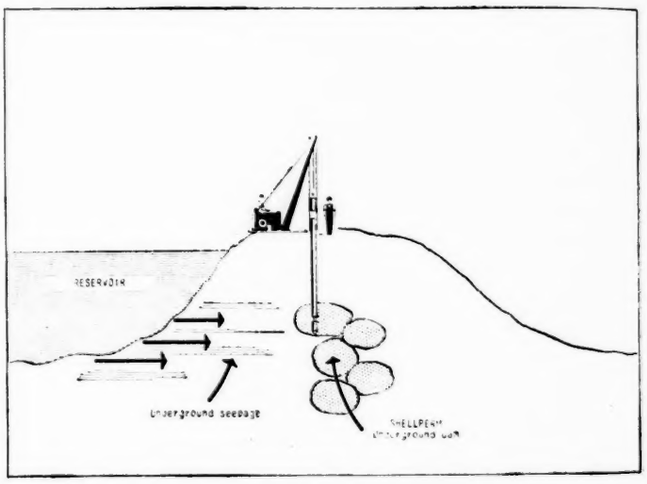
• **OTHERS.**—In addition to approval of the new standard on methyl chloride, action has been taken to make available for peacetime use the standards defining allowable concentrations for xylene, and for manganese, both of which were originally approved as American War Standard in 1943. No changes have been made in the peacetime editions.

Other standards in this series define the allowable concentrations for carbon monoxide, hydrogen sulfide, carbon disulfide, benzene, cadmium, chromic acid and chromates, mercury, lead and certain of its inorganic compounds, toluene, oxides of nitrogen, methanol, styrene monomer, formaldehyde, and trichloroethylene.

UNDERGROUND DAM

developed by Shell to control subsurface water seepage.

Subsurface seepage, one of the chief causes of loss or pollution of water, may now be controlled by constructing a permanent underground dam by means of an asphalt emulsion, it has been announced by Shell Oil Company. The subterranean barrier is built without excavating, by injecting the asphalt emulsion into the earth through a pipe. Already used to check serious loss of irrigation water through an earth dam on the Santa Ana River in California, the new method is marketed under the trade name of Shellperm.



An impermeable barrier against water seepage from a reservoir is injected into a retaining dyke as overlapping globules of asphalt.

• **USES.**—The underground barrier may prevent serious leakage of water through banks of reservoirs, check contamination caused by infiltration, and prevent sea water from seeping into fresh water wells. Aside from its role in water conservation, Shellperm can also be used to check seepage around tunnels, roadbeds, or other subsurface structures, without the use of such relatively expensive techniques as sheet piling. The new process is especially significant, according to a Shell spokesman, because heretofore control of underground movement of water has been costly and difficult at depths of more than a few feet.

• **HOW IT WORKS.**—The Shellperm process employs an emulsion of asphalt in water, which is pumped under low pressures through a metal pipe driven into the ground. Emerging from the pipe, the emulsion spreads out roughly in the form of a ball. Chemicals mixed with the emulsion then cause the asphalt to coalesce, producing a mass impermeable to water.

Following the first injection, the pipe is raised, and additional Shellperm is pumped down to form a second

impermeable mass. After repeated injections have produced a vertical asphalt column, the pipe is moved and additional injections are made to create another column. The process is repeated until abutting or overlapping columns form an underground dam.

ENVIRONMENT LABORATORY

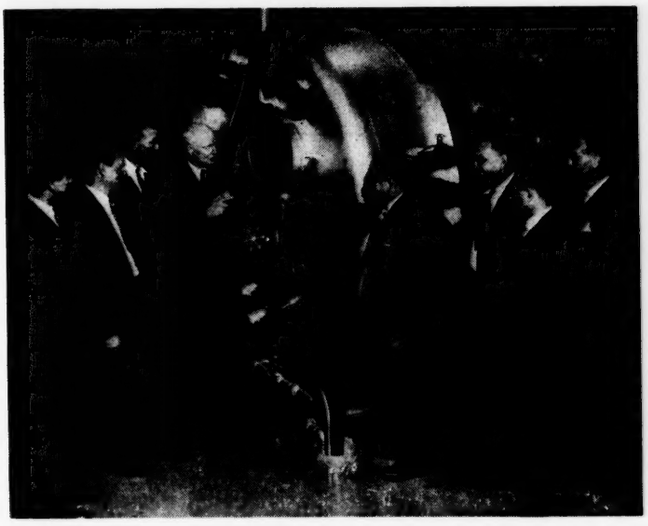
under development as cross-campus division at University of Illinois will offer widely variable and closely controlled conditions.

A major research center planned for the betterment of living and working conditions on this planet is the Physical Environment Unit taking shape as an inter-department facility of the University of Illinois. The goal of sponsors of the project is to provide means for controlling the various factors of physical environment in large test spaces within close tolerances and over wide ranges so that both human and animal response can be tested. The physical environment factors involved include: Air temperature, humidity, motion, pressure and cleanliness; noise, vibration; illumination; radiation, etc.

• **WHY.**—Need for such a cooperative unit has gained increasing awareness among technologists, engineers, biologists, physicians, and others because of the ever-widening areas of similar interest among those concerned with the comfort, health, and efficiency of man under conditions met in modern civilization. Problems encountered during the war, both in the Armed Forces and in industry, emphasized the great need for more knowledge of the effect of environment on people. More and more persons on the university staff trained in different professions and sciences became interested as larger and more varied problems presented the need for cooperative research teams. It was obvious that both biology and technology were required to attack successfully the larger problems.

• **HOW.**—A nucleus of cooperative research had already been formed as early as 1935 when the university's department of mechanical engineering and department of medicine began a study sponsored by ASHVE to determine the relative weight of various factors in comfort air conditioning. Professor N. Glickman has since continued this work under the supervision of Drs. R. W. Keeton and Ford K. Hick of the department of medicine and with the cooperation of the department of mechanical engineering in designing, building, and operating mechanical equipment and instruments.

Dr. Keeton and Professor M. K. Fahnestock, assistant director of the engineering experiment station, are credited by university staff members with sparking the program which has resulted in the larger overall Physical Environment Unit. The eventual scope and physical equipment of the unit are still undetermined, but already two impressive indications of the direction in which its sponsors are working are in evidence at both the Urbana and Chicago locations of the university campus.



Low-pressure chamber in mechanical engineering laboratory at Urbana. Left to right are M. E. Bunch, A. C. Williams, E. P. Heckel, Dr. Robert W. Keeton, M. K. Fahnestock, F. R. Stegerda, Dr. V. A. Guillemin, Jr., and N. A. Parker.

• **URBANA.**—At Urbana, the engineering experiment station of the department of mechanical engineering has erected a small physical environment laboratory to provide limited facilities for use of departments on that campus. At present it houses a six-man low-pressure chamber which can be used for controlling pressures from 5 inches to 29.9 inches Hg abs. It is planned to install equipment to control air temperature in the chamber over a range from 50F to 120F and humidity from 40% to 80%. At the present time two departments, the department of psychology, and the department of physical fitness, are conducting work in the chamber.

The department of psychology is studying the effect of anoxia on white rats at birth as reflected by learning ability in later life as adult animals. Within three hours of birth, the rats are subjected to a simulated altitude of 45,000 ft in the decompression chamber. When they grow up, their learning ability will be compared with that of a contemporary litter of normal control rats. The department of physical fitness is testing the effect of decompression upon an already observed correlation between grades given by university flight instructors and predictions of flying ability based on ground level tests of physical fitness. Better correlation of pre-flight physical fitness tests with eventually proved flying ability is the aim of work in the decompression chamber.

• **CHICAGO.**—At Chicago, there is under construction a larger physical environment laboratory attached to the School of Medicine. Facilities of this laboratory are an extension of the overall inter-department Physical Environment Unit which will offer a small skeleton staff headed by Dr. A. C. Ivy, director of the unit, and with Dr. John P. Marbarger, director of research for the unit. This staff will act on a service basis for any department of the university, while the work itself will be done by and under the direction of the established departments themselves. Facilities of

the Chicago laboratory will include pressure chambers and air conditioning devices offering a wide range of controlled conditions.

PIPE CORROSION

studied by AISI committee in effort to determine why zinc coatings vary in effectiveness.

The tendency of the zinc coating or galvanizing on steel water pipe to dissolve, varies with the substances in solution in the water, it is revealed in a study being conducted by the Committee on Steel Pipe Research of American Iron and Steel Institute. The first phase of this project, in progress for 1½ years, was reported at the annual convention of the National Association of Corrosion Engineers at Cincinnati, April 13, by R. B. Hoxeng, research associate of Case Institute of Technology, and C. F. Prutton of Carl F. Prutton and Associates, both of Cleveland.

• **EXCEPTIONS.**—The program was designed to determine the causes of exceptions to the usual long life of galvanized steel pipe in severely corrosive natural waters, and to find means of overcoming this trouble. Ordinarily no pitting of the steel results, because of the electrolytic protection afforded by the zinc. When zinc and steel are in contact in water, the tendency to dissolve the zinc is greater than the tendency to dissolve the steel, so that so long as the zinc remains, the steel is protected. Some exceptional cases have been reported, however, in which galvanized steel was pitted in hot water, changing the normal relationship between the two metals.

• **CAUSES.**—In studying these exceptional cases it was discovered that bicarbonates and nitrates accelerated the reversal of the normal relationship, while chlorides and sulphates prevented the reversal. For a natural water, therefore, the probability of reversal of the normal behavior would depend on the relative quantities of these chemical substances in the water and to a less extent on the temperature of the water.

NATIONAL PLUMBING CODE

object of meetings of Government and engineering groups.

The first of a series of meetings aimed at safeguarding the health of the community and the nation was held in Washington, D. C., April 19th, when representatives of the National Bureau of Standards and engineering and plumbing groups gathered at the invitation of The American Society of Mechanical Engineers and the American Public Health Association. Their goal is the establishment of a national standard plumbing code capable of adoption throughout the entire country.

• **BASIS.**—An American Standard Plumbing Code of minimum requirements drafted by a committee representing thirty cooperating organizations under the sponsorship of the ASME and the APHA, will serve as the groundwork for the national code to be compiled. The ASA code, the result of 11 years' effort, has been published recently by ASME in a 75-page booklet.

• **NEED.**—The need for a nationwide code has been recognized for a long time. At present there are over 1600 plumbing codes in the land resulting in a situation where plumbing requirements for safety and health vary chaotically between, and even within, different sections of the country. Uniformity of requirements would be of great benefit to the general public, building owners, tenants, and the manufacturers of plumbing supples as well as the plumber who installs the equipment.

Meetings will be held in various cities of the country and it is estimated that the committee will require from six months to a year to accomplish its work.

NEWS BRIEFS

• Proved *natural gas reserves* in the United States on December 31, 1948, showed an increase of 8 trillion cubic feet over the similar figure for 1947. Discoveries of new natural gas fields and extensions of previous estimates of reserves in existing fields accounted for the increase.

• Following tests conducted by Dr. Hartman and Professor Hansen of Oregon State College which showed that D'Anjou pears could be kept until late May in storage room air *purified by activated carbon*, Duckwall Brothers, Inc., of Hood River, have installed activated carbon units throughout their storage plants, capacity of which is over 200 carloads of apples and pears. Theory is that activated carbon adsorbs self-ripening gases given off by fruit.

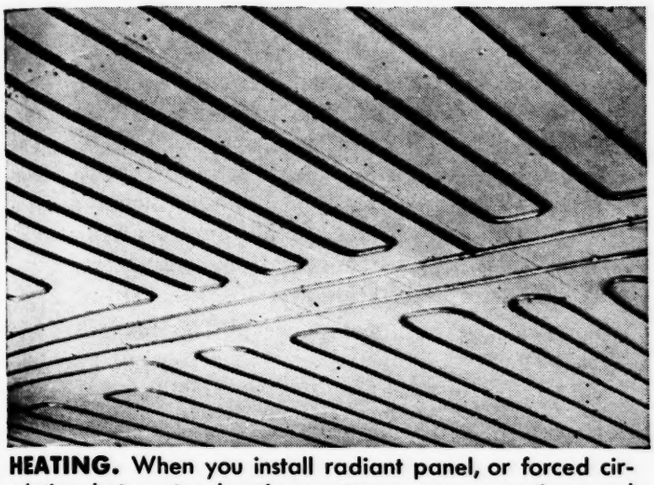
• Dr. Irving P. Krick, whose *long range weather forecasts* in the *American Fruit Grower* have been right for two years, says that violent weather will characterize the spring of 1949 with heavier than usual precipitation along the Atlantic seaboard and a real threat of late frosts east of the Rockies.

• The record cold month of January boosted gas consumption in Southern California to the *greatest amount for heating* ever generated in this area, according to Walter R. Dicus, president of the Institute of Gas Heating Industries, Inc. On two peak days of January 4 and 10, the energy consumed in gas was equivalent to the output of 20 Boulder Dams, Mr. Dicus said.

• Three large, 19-knot passenger-cargo liners now being built for the American President lines at Camden, N. J., and two ships of the American Export Lines being built by Bethlehem Steel Company, will be *completely air conditioned* by Carrier Corporation.

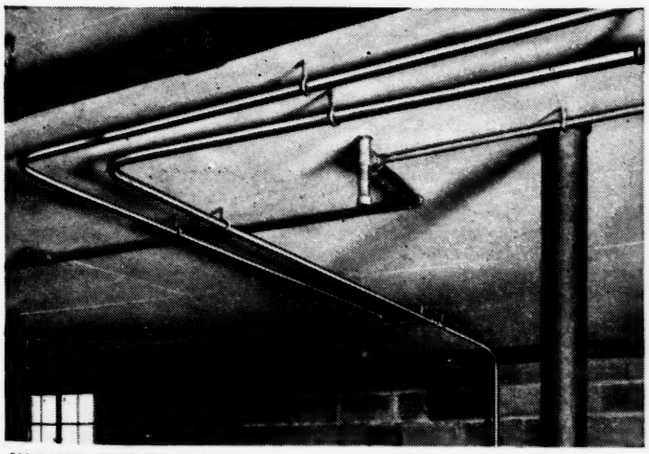
TROUBLE always costs more than

REVERE COPPER WATER TUBE



HEATING. When you install radiant panel, or forced circulation hot water heating systems, you save time and trouble with Revere Copper Water Tube. You can bend this tube readily, and joints are quickly made with either soldered or compression fittings.

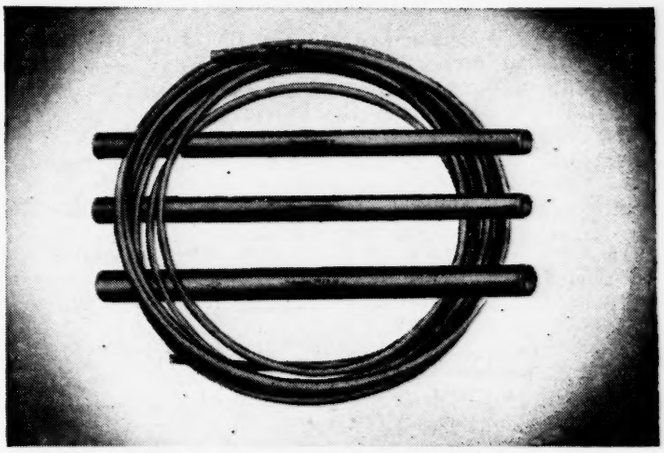
SOIL, WASTE AND VENT LINES. Revere Copper Water Tube is used for drainage because it is so highly resistant to corrosion attack. The interior remains smooth, permitting unobstructed flow and eliminating the tendency of lines to clog.



WATER SUPPLY. You insure a free flow of sparkling-clear water when you use Revere Copper Water Tube for hot and cold water lines. And, because copper does not rust, the lines can usually be a size smaller than would be required with rustable pipe.

* * *

You can specify or install such other long lived Revere materials as Red-Brass Pipe; Sheet Copper and Herculoy for tanks, ducts, pans and trays; Dryseal Copper Refrigeration Tube (dehydrated and sealed); Copper oil burner, heat control and capillary tubes. The Revere Technical Advisory Service, Architectural, is always ready to serve you. Call your Revere Distributor.



LOOK FOR the Revere name and the type, which are stamped on Revere Copper Water Tube at regular intervals. These marks are your assurance of full wall thickness and the correct dimensional tolerances so essential for tight soldered joints.

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SPRING MEETING CRUISE

to be held by ASRE in June on St. Lawrence and Saguenay Rivers.

Four hundred members and guests are scheduled to participate in the spring meeting and cruise arranged by the American Society of Refrigerating Engineers for June 5-9. The S. S. Richelieu, which will leave Montreal June 5, has been engaged for a 400-mile cruise on the St. Lawrence and Saguenay rivers. A program has been arranged to include three technical sessions, an engineering conference, and shore trips. A stopover will be made at Bagotville to inspect the new plant of the Aluminum Company of Canada at Arvida and the hydroelectric power plant at Shipshaw. One technical session will cover the field testing of domestic refrigerators.

• **PROGRAM.**—During the cruise dancing is scheduled for every evening in addition to the annual cocktail party and dinner-dance on Tuesday. Committee meetings to further the activities of ASRE have been arranged for convenient times.

A detailed program of the technical sessions follow:

Monday, June 6

9 a.m.—Specific Heat of Foodstuffs, by Horace E. Staph, University of Texas

The Action of Desiccants in the Removal of Water from Refrigerating Systems, by B. J. Sterk, Socony-Vacuum Laboratories

Determination of Water and Non-Condensible Gas Content of Freon-12 Gas by a Dew-Point Method, by H. M. Elsey, Westinghouse Electric Corp., Research Laboratories

Moisture in Walls of Cold Storage Rooms, by Carl Munters, Stocksund, Sweden

7:30 p.m.—Refrigeration Abstracts, by D. K. Tressler, Westport, Conn.

Air Cycle Refrigeration and Its Applications, by Paul Scofield, AiResearch Manufacturing Co.

A New Canadian Laboratory for Arctic Testing, by J. L. Orr and D. G. Henshaw, National Research Council, Canada

Tuesday, June 7

2 p.m.—Theory and use of the Capillary Tube Expansion Device—Part II, Non-Adiabatic Flow, by M. M. Bolstad, University of Missouri, and R. C. Jordan, University of Minnesota

New Development in Absorption Refrigeration, by A. A. Berestneff, Carrier Corp.

Cold Rubber—Its Preparation, Properties, and Application, by Douglas Chalmers, Gates Rubber Co.

Wednesday, June 8

7:30 p.m.—Domestic Refrigerator Engineering Conference, with discussion on Domestic Refrigerator Field Testing led by R. F. Roider, General Electric Co.

• • •

• *More building materials* were produced in 1948 than during any previous year on record, according to the Department of Commerce. The Department's Composite Index of Production for Selected Construction Materials shows an increase of 5% over 1947, the previous record year.

NDHA MEETING

to be held at Massachusetts summer resort features social and technical programs.

The 40th annual meeting of the National District Heating Association will be held May 24 to 27 at the New Ocean House, Swampscott, Mass. The convention will feature two varied programs; an entertainment program with events for members and ladies, and a technical program consisting of panel discussions, committee reports, and technical papers.

• **VARIETY.**—The social program this year includes a ladies' bridge, shore dinner, boat and bus trips, golf tournament, moving pictures, sightseeing and inspection trips, and the annual reception and banquet. Facilities of the hotel include golf, surf bathing, dancing, horseback riding, fishing, tennis, archery, etc. The technical program includes a panel discussion on views of the engineer, architect and building owner regarding future building plans, sessions on rates and regulations, distribution, steam station engineering, and other phases of association activity.

Some of the technical papers to be presented are as follows:

Wednesday, May 25th

9:30 a.m.—Cooling with Heat, by O. Eldridge Gammill, Jr., Carrier Corp.

Control of Steam Load at Notre Dame University, Brother Borromeo, C.S.C., Notre Dame University.

Thursday, May 26th

9:30 a.m.—Should We Buy a Larger Boiler?, by D. L. Detwiler and Robert B. Donworth, Allegheny County Steam Heating Co.

Kendall Square Station, A Combination Steam Heating and Electric Generating Plant, by R. D. Stauffer, New England Gas & Electric Association.

The Detroit Edison Company Installs a 200,000 Pound Per Hour Boiler, by R. G. Felger, The Detroit Edison Co.

Operating Experience with Desuperheater Station at Rochester, by George M. Johnson, Rochester Gas and Electric Co.

The Effect of Relative Humidity on Steam Consumption at Various Temperatures, by Thomas P. Brown, Jr., New York Steam Corp.

2:00 p.m.—Ring Balance Meter, by A. A. Markson, Hagan Corp.

Further Developments of Air Testing of Meters, by W. G. Gillim, New York Steam Corp.

Economic Study of Condensate Meters vs. Shunt Meters, by Oscar E. Hauser, The Detroit Edison Co., and Richard H. Brown, Rochester Gas and Electric Corp.

District Heating Progress in Europe, by Arthur S. Griswold.

Friday, May 27th

9:30 a.m.—Present Practice with Cell-Concrete, by Paul Chenzoff, Philadelphia Electric Co., and Foster L. Stephens, Allegheny County Steam Heating Co.

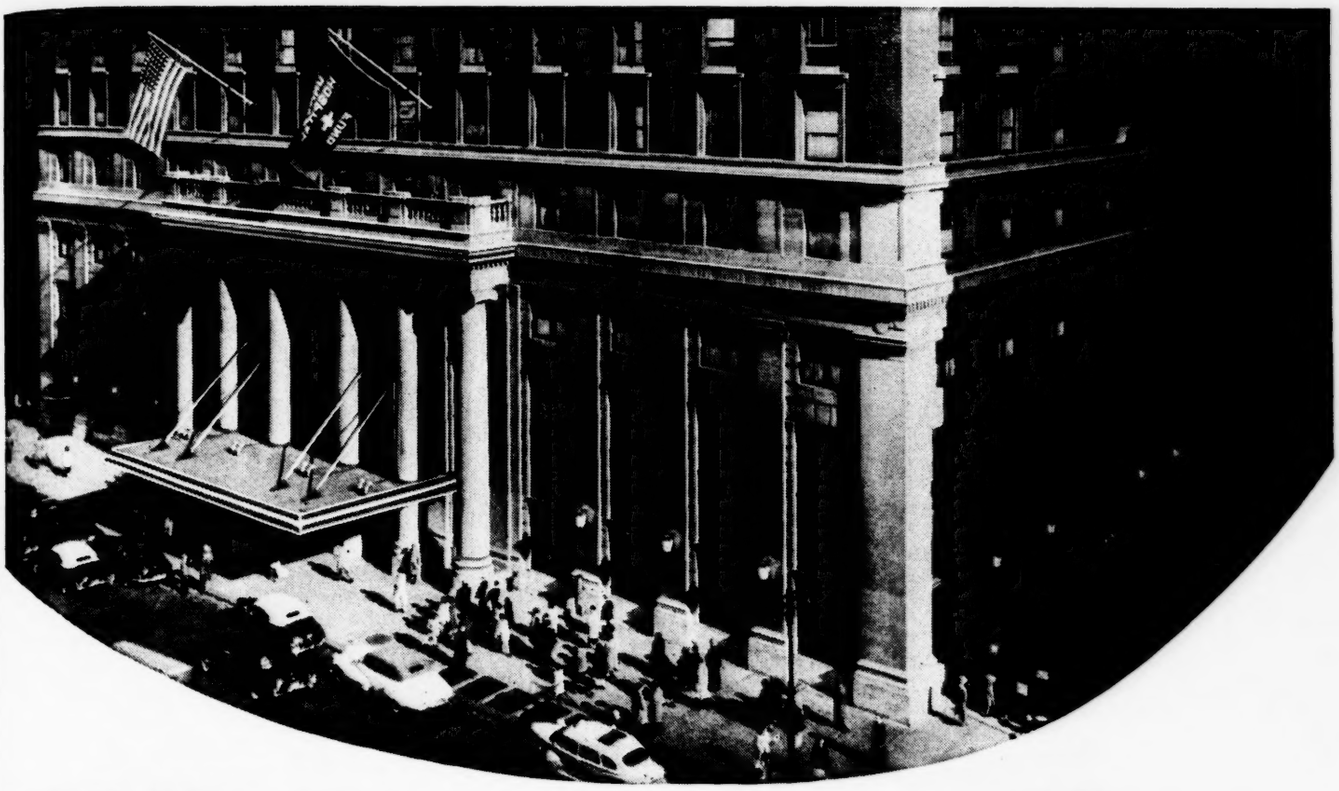
Prefabricated Steam Mains, by Vernon J. Suche, Union Electric Co. of Missouri, and John C. Haroldson, Duluth Steam Corp.

Simplification of Mains and Service Connections, by Frank J. Schlachter, The Detroit Edison Co.; Julius J. Schenk, Rochester Gas and Electric Corp., and Alexander Douglas, Cleveland Electric Illuminating Co.

The Use of Cell-Concrete to Insulate a Reconditioned Steam Main, by Frank J. Schlachter, Ernest T. Smith and Glen D. Winans, The Detroit Edison Co.

Construction and Cost of an 8-in. Steam Main Extension in Z-Crete Conduit, by George H. Gowdy and F. G. Davis, Cambridge Steam Corp.

High-Temperature Fluid Heating, by Paul L. Geiringer, American Hydrotherm Corp.



STATLER HOTEL REPORTS ON CHRYSLER AIRTEMP EQUIPMENT:

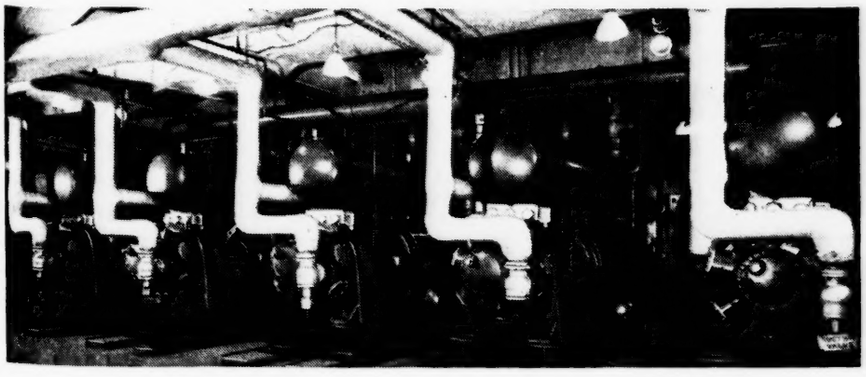
"In action 12 years— only $150 in repair parts!"

... another example of CHRYSLER ENDURANCE-ENGINEERED *dependability*

● New York's Hotel Statler, a leading member of the Statler chain—"where you really *are* a guest"—lives up to this famous slogan by treating patrons in its four ballrooms to an atmosphere of *cool*, refreshing comfort dependably provided by Chrysler Airtemp equipment.

Permanent "guests" at this hotel since 1937, the five 75 hp. radial condensing units have hummed along smoothly—year in, year out—*with only $150 in repair parts needed to maintain 100% operating efficiency!*

Look to Chrysler Airtemp, as Statler and so many others do, for superior performance, dependable operation, and minimum maintenance. Discuss your cooling problem with your local Airtemp dealer. See yellow pages of phone book or write us direct.



View of the five Airtemp Radial Compressors, delivering a total of 375 hp., which cool the Statler grand ballroom and 3 other ballrooms.

Chrysler Airtemp

AIR CONDITIONING • HEATING • COMMERCIAL REFRIGERATION

AIRTEMP DIVISION OF CHRYSLER CORPORATION • Dayton 1, Ohio • In Canada: Therm-O-Rite Products, Ltd., Toronto

DEGREE-DAYS FOR MARCH, 1949

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 21st Year of Publication of Monthly Degree-Day Data

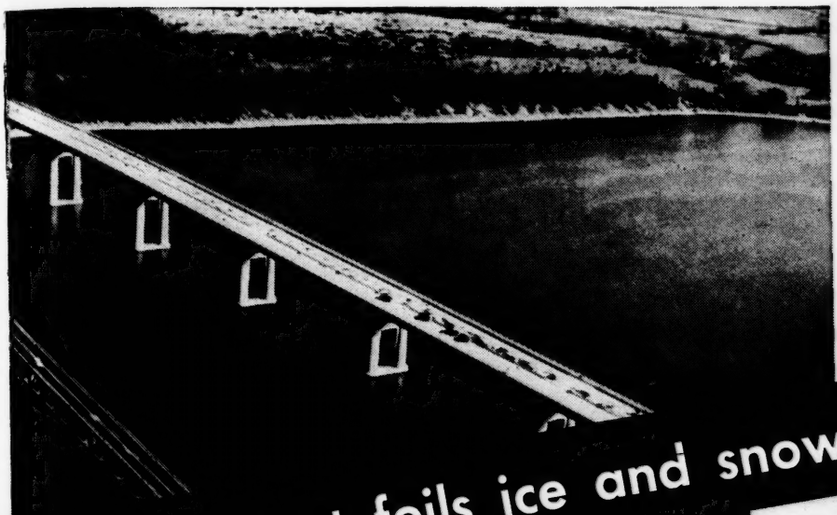
City	March			Cumulative, Sept. 1 to Mar. 31			Heating Season[1]
	1949	1948	Normal	1948-49	1947-48	Normal	Normal
Abilene, Texas (A)	298	411	273	2629	2802	2034	2061
Albany, New York (A)	910	1029	980	5382	6565	5848	6580
Albuquerque, New Mexico (A)	(a)	746	527	(a)	4355	3970	4298
Alpena, Michigan (C)	1118	1198	1213	5961	6704	6873	8299*
Anaconda, Montana (C)	1107	1245	1081	7663	6995	6737	8357**
Asheville, North Carolina (C)	562	473	555	3131	3653	3831	4232
Atlanta, Georgia (A)	386	307	388	2184	2760	2758	2890
Atlantic City, New Jersey (C)	717	716	806	3551	4363	4437	5176
Augusta, Georgia (C)	289	207	273	1511	2265	2137	2161
Baker, Oregon (C)	799	938	880	6794	5611	5904	7163
Baltimore, Maryland (C)	578	562	701	3279	4081	4163	4533
Billings, Montana (A)	1028	1093	955	6907	6199	6209	7119
Binghamton, New York (C)	872	908	995	5033	5937	5960	6808
Birmingham, Alabama (A)	368	290	260	2121	2686	2283	2352
Bismarck, North Dakota (A)	1269	1481	1283	8317	8320	8152	9192
Block Island, Rhode Island (C)	839	874	911	4079	4942	4678	5788
Boise, Idaho (A)	681	842	651	5947	5155	4881	5552
Boston, Massachusetts (A)	799	837	908	4364	5338	5230	6045
Bozeman, Montana (C)	1083	1231	1096	7503	7007	6993	8521**
Buffalo, New York (A)	961	940	1032	5055	5838	5800	6822
Burlington, Iowa (A)	851	882	(a)	5515	5695	(a)	(a)
Burlington, Vermont (A)	1057	1156	1088	5932	7086	6584	7514
Butte, Montana (C)	1181	1301	1048	8147	7478	6683	8235**
Cairo, Illinois (C)	518	497	539	3213	3798	3708	3909
Canton, New York (C)	1117	1122	1160	6106	7166	7002	8020
Charleston, South Carolina (C)	263	187	242	1106	1908	1733	1769
Charlotte, North Carolina (C)	395	336	428	2232	3067	2961	3120
Chattanooga, Tennessee (A)	432	346	415	2627	3126	2974	3118
Cheyenne, Wyoming (A)	1020	1155	995	6644	6378	6174	7466
Chicago, Illinois (C)	817	857	845	4852	5373	5246	6077
Cincinnati, Ohio (C)	596	556	676	3589	4257	4351	4684
Cleveland, Ohio (A)	862	1056	930	3846	4571	5371	6155
Columbia, Missouri (C)	688	724	694	4402	4570	4597	4922
Columbia, South Carolina (C)	(a)	242	301	(a)	2448	2301	2364
Columbus, Ohio (C)	711	648	778	4144	4827	4891	5398
Concord, New Hampshire (A)	939	1050	1011	5692	6854	6332	7353
Concordia, Kansas (C)	808	960	735	5343	5220	4908	5315
Dallas, Texas (A)	268	380	267	2345	2657	2247	2256
Davenport, Iowa (C)	842	885	893	5361	5660	5718	6289
Dayton, Ohio (A)	770	739	744	4563	5257	4787	5264
Deer Lodge, Montana (C)	1085	1192	1056	7982	6896	7125	8672**
Denver, Colorado (C)	765	968	800	5266	5214	5073	5874
Des Moines, Iowa (C)	892	993	890	5792	5833	5825	6384
Detroit, Michigan (A)	909	932	973	5054	5798	5691	6490
Devils Lake, North Dakota (C)	1478	1551	1323	8953	8962	8694	9970
Dodge City, Kansas (A)	722	965	688	5021	5098	4646	5035
Dubuque, Iowa (C)	921	971	958	5847	6114	6152	6790
Duluth, Minnesota (C)	1267	1298	1265	7487	8156	7945	9483
Eastport, Maine (C)	1031	1151	1110	5875	6624	6612	8520**
Elkins, West Virginia (A)	796	624	763	4505	5036	5019	5697
El Paso, Texas (A)	257	444	282	2778	2861	2383	2428
Ely, Nevada (A)	1030	1198	(a)	7604	6573	(a)	(a)
Erie, Pennsylvania (C)	878	863	973	4555	5289	5407	6273
Escanaba, Michigan (C)	1159	1284	1262	6502	7166	7290	8771
Evansville, Indiana (A)	628	568	620	3809	4401	3968	4244
Fort Smith, Arkansas (A)	(a)	505	397	(a)	3356	3054	3147
Fort Wayne, Indiana (A)	833	860	818	5001	5735	5321	5925
Fort Worth, Texas (A)	255	403	217	2314	2682	2121	2148
Fresno, California (A)	327	370	316	2694	2371	2199	2334
Galveston, Texas (C)	(a)	176	78	(a)	1438	1016	1016
Grand Junction, Colorado (A)	687	911	672	5829	5507	5046	5548
Grand Rapids, Michigan (C)	909	940	964	5170	5747	5827	6535
Green Bay, Wisconsin (C)	1069	1168	1125	6418	7017	6903	7825
Greensboro, North Carolina (A)	499	411	474	2925	3630	3319	3529
Greenville, South Carolina (A)	400	352	446	2380	3054	3185	3380
Harrisburg, Pennsylvania (A)	709	681	803	4266	4946	4880	5375
Hartford, Connecticut (A)	825	890	887	4755	5809	5303	6036
Hatteras, North Carolina (C)	401	301	465	1729	2285	2316	2571
Havre, Montana (C)	1119	1246	1169	7971	6884	7557	8700
Helena, Montana (A)	1124	1203	1004	7993	6817	6615	7894**
Houston, Texas (C)	127	191	65	1124	1549	1157	1157
Huron, South Dakota (A)	1065	1170	1092	7290	7489	7167	8004
Indianapolis, Indiana (A)	744	683	756	4576	4868	4855	5298
Jackson, Mississippi (A)	265	234	(a)	1700	2251	(a)	(a)
Kansas City, Missouri (A)	684	788	691	4532	4734	4644	4956
Knoxville, Tennessee (A)	491	360	496	2847	3297	3460	3670
La Crosse, Wisconsin (A)	1038	1112	1033	6648	7118	6611	7322
Lander, Wyoming (A)	985	1192	1028	7505	6700	6694	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 112]



New Raymond E. Baldwin Bridge, connecting Old Lyme and Old Saybrook where the Connecticut River flows into Long Island Sound. Project Engineer for the State—Col. Howard S. Ives.

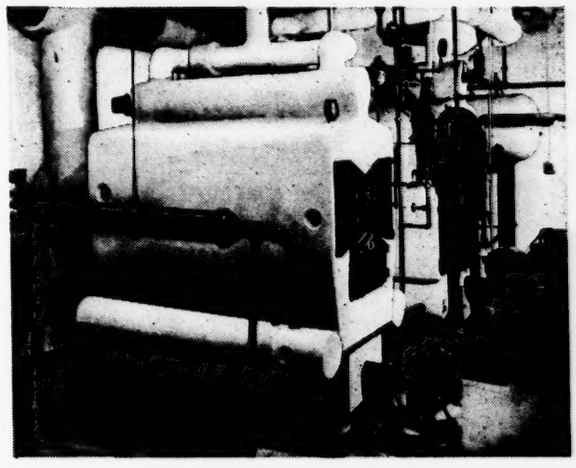
Radiant heat foils ice and snow on new bridge

DISCONCERTED, to say the least, is the motorist who slides through a narrow toll gate on smooth-as-glass ice. Connecticut's State Highway Department, collaborating with the Old Lyme-Old Saybrook Bridge Commission on the new Raymond E. Baldwin Bridge, successfully eliminated this menace to motorist, attendant, fenders and toll house with a novel radiant heating installation.

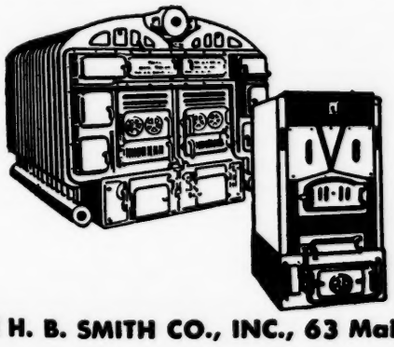
An oil-fired No. 240 Mills boiler supplies hot water which circulates through pipes embedded in the roadway adjoining the toll booths, melting ice and snow and keeping the roadway clear and ice-free. The oil burner operates only during icing periods; at other times 300 gallons of anti-freeze keep the system from freezing.

Unusual applications like this prove the versatility and dependability of Smith-Mills boilers . . . and their ability to deliver lowest-cost, efficient heating year after year. That's why, on even the toughest heating jobs, you're sure of satisfaction when you specify a boiler built by H. B. Smith.

Roadway, morning after a storm. Clear sections remained free of snow all during the storm; roadway in the foreground, though scraped, is still covered with ice patches.



Boiler room in Administration Building. The No. 340 Mills heats the building. Heating Contractor—William M. Ford; H. B. Smith Distributor—Marsden and Wasserman, Inc., Hartford, Conn.



H.B. Smith

CAST-IRON BOILERS

THE H. B. SMITH CO., INC., 63 Main St., Westfield, Mass., Offices and Representatives in Principal Cities

Degree-Days for March, 1949 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 21st Year of Publication of Monthly Degree-Day Data

City	March			Cumulative, Sept. 1 to Mar. 31			Heating Season[1]
	1949	1948	Normal	1948-49	1947-48	Normal	Normal
Lansing, Michigan (A)	965	989	1035	5535	6224	6237	7048
Lewiston, Maine (O)	969	1051	1093	5655	6661	6625	7707
Lincoln, Nebraska (C)	860	979	840	5835	5652	5483	5999
Little Rock, Arkansas (A)	(a)	431	353	(a)	3155	2733	2811
Livingston, Montana (C)	963	1137	967	6649	6357	5985	7245**
Los Angeles, California (C)	279	302	239	1699	1286	1255	1504
Louisville, Kentucky (A)	589	512	589	3565	4072	3916	4180
Lynchburg, Virginia (A)	566	492	564	3274	3965	3707	3980
Macon, Georgia (C)	321	226	260	1675	2303	2168	2201
Madison, Wisconsin (C)	1001	1079	1054	6109	6691	6611	7429
Marquette, Michigan (C)	1185	1238	1249	6548	7091	7164	8693*
Memphis, Tennessee (A)	438	424	384	2697	3263	2854	2950
Meridian, Mississippi (C)	285	233	245	1710	2290	2136	2160
Milwaukee, Wisconsin (A)	983	1029	1023	5750	6260	6208	7245
Minneapolis, Minnesota (A)	1103	1168	1094	6910	7326	7044	7850
Montgomery, Alabama (C)	269	197	208	1420	1994	1884	1884
Nantucket, Massachusetts (A)	850	860	899	4368	5121	4811	5957
Nashville, Tennessee (A)	493	405	477	2953	3511	3327	3507
New Haven, Connecticut (A)	811	878	899	4464	5489	5129	5895
New Orleans, Louisiana (C)	144	110	59	863	1363	1024	1024
New York, New York (C)	701	714	771	3744	4699	4608	5274***
Nome, Alaska† (A)	(a)	1867	1756	(a)	9012	10642	14580**
Norfolk, Virginia (C)	460	415	521	2305	3094	3104	3350
North Head, Washington (C)	579	652	623	4155	3654	3755	5452**
North Platte, Nebraska (C)	885	1022	875	6161	5643	5681	6366
Oakland, California (A)	376	466	363	2858	2542	2392	3143**
Oklahoma City, Oklahoma (C)	467	639	465	3487	3721	3451	3613
Omaha, Nebraska (A)	882	1023	868	5903	5831	5633	6131
Oswego, New York (C)	938	987	1060	5175	6005	5993	7088
Parkersburg, W. Virginia (C)	654	533	670	3795	4383	4371	4775
Peoria, Illinois (A)	805	857	862	5187	5502	5535	6109
Philadelphia, Pennsylvania (C)	637	638	685	3537	4779	4227	4737***
Phoenix, Arizona (C)	148	256	152	1782	1633	1405	1405
Pittsburgh, Pennsylvania (C)	711	659	787	3965	4918	4734	5235
Pocatello, Idaho (A)	815	1002	843	6727	5991	5696	6655
Portland, Maine (A)	986	1060	1017	5711	6498	6105	7218
Portland, Oregon (C)	526	585	558	4070	3427	3732	4469
Providence, Rhode Island (C)	765	793	890	4216	5187	5206	6015
Pueblo, Colorado (A)	692	1026	732	5244	5531	4872	5514
Raleigh, North Carolina (C)	433	352	446	2368	3215	3051	3234
Rapid City, South Dakota (A)	1062	1108	1010	6880	6262	6150	7118
Reading, Pennsylvania (C)	672	655	794	3954	4751	4876	5389
Red Bluff, California (A)	423	477	(a)	2917	2592	(a)	(a)
Reno, Nevada (A)	767	886	753	5901	5176	4902	5892
Richmond, Virginia (C)	508	451	543	2828	3653	3449	3695
Rochester, New York (A)	951	958	1029	5213	6003	5854	6732
Roseburg, Oregon (C)	512	595	546	4010	3548	3636	4428
Roswell, New Mexico (A)	(a)	609	428	(a)	3816	3304	3484
Sacramento, California (C)	362	436	357	2810	2524	2393	2653
St. Joseph, Missouri (A)	758	889	682	5095	5189	4803	5161
St. Louis, Missouri (C)	645	645	657	3966	4353	4309	4585
Salt Lake City, Utah (A)	702	911	722	6133	5284	4866	5555
San Antonio, Texas (A)	130	234	74	1530	1839	1202	1202
San Diego, California (A)	272	283	251	1709	1388	1350	1645
Sandusky, Ohio (C)	836	849	915	4595	5345	5299	6208
San Francisco, California (C)	366	412	353	2506	2111	2123	3264**
Sault Ste. Marie, Michigan (A)	1302	1336	1314	6993	7623	7629	9285**
Savannah, Georgia (A)	239	153	167	1044	1710	1490	1490
Scranton, Pennsylvania (C)	820	807	893	4716	5564	5445	6129
Seattle, Washington (C)	543	611	620	4202	3654	3704	4934**
Sheridan, Wyoming (A)	1041	1126	1048	7131	6541	6837	8008
Shreveport, Louisiana (A)	(a)	293	202	(a)	2427	1938	1938
Sioux City, Iowa (A)	984	1066	967	6671	6386	6245	6898
Spokane, Washington (A)	836	890	778	6706	5702	5485	6355
Springfield, Illinois (C)	706	725	760	4503	4818	4951	5373
Springfield, Missouri (A)	657	719	626	4128	4420	4149	4428
Syracuse, New York (A)	917	990	1004	5206	6202	5984	6893
Tacoma, Washington (C)	582	663	648	4478	3967	4086	5181**
Terre Haute, Indiana (A)	717	696	663	4440	5010	4539	4872
Toledo, Ohio (A)	878	900	905	4998	5786	5372	6077
Topeka, Kansas (C)	698	819	682	4678	4839	4635	4969
Trenton, New Jersey (C)	690	680	735	3872	4756	4450	4933
Utica, New York (O)	895	1018	989	4965	6428	5955	6796
Valentine, Nebraska (C)	999	1118	980	6739	6327	6205	7039
Walla Walla, Washington (C)	631	687	598	5118	4265	4274	4808
Washington, D. C. (C)	565	522	694	3272	4026	4253	4626
Wichita, Kansas (A)	661	781	648	4545	4561	4421	4673
Williston, North Dakota (C)	1253	1405	1280	8387	7946	8238	9323
Winnemucca, Nevada (C)	793	903	767	6241	5405	5411	6427**
Yakima, Washington (A)	658	759	620	5965	5033	5053	5599

(a) Data not available.
†Nome data are for February.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

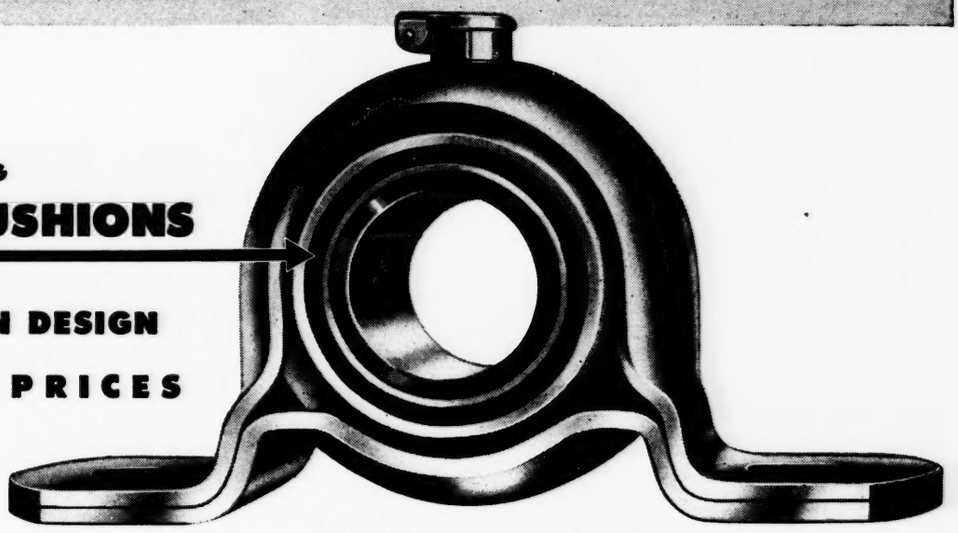
[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

TRIANGLE PILLOW BLOCK

SHOCK—ABSORBING
BUILT-IN CUSHIONS

- **TIME-PROVEN DESIGN**
- **NEW LOW PRICES**

Special mountings designed to meet individual conditions



WRITE DEPT. C TODAY

TRIANGLE MANUFACTURING COMPANY
388-400 DIVISION STREET OSHKOSH, WISCONSIN

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weil "TVC" LOW RETURN CONNECTION CAST IRON RECEIVER

GUARANTEED PERFORMANCE

- *Precision-built for longer life*
- *Every pump part made and assembled in the Weil Factory*
- *Pre-tested before shipping*
- *Pump comes completely assembled*

TYPE R
Hot and Chilled Water Circulating
Ball-bearing — once a year lubrication
Capacity — 10 to 750 GPM
(write for bulletin R5500)

TYPE TR HORIZONTAL
Low and High Pressure Systems
Ball-bearing — heavy duty
Capacities to 100,000 sq. ft. E.D.R.
Pressures to 125 P.S.I.

Low return connections provide freedom of layout. Eliminates underground lines. Overhead lines may be used. Has extremely low waterline—cast iron receiver. Capacities—500 to 10,000 sq. ft. E.D.R.
(write for bulletin TVC-300)

TYPE "TVC" CONDENSATE
LOW PRESSURE SYSTEMS

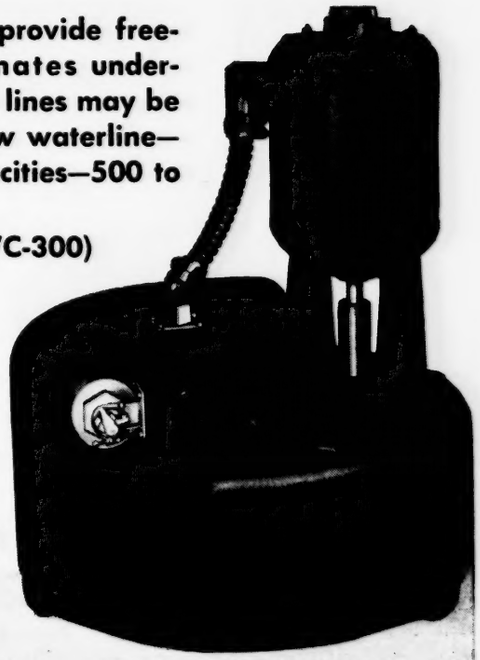


Fig. 302

weil PUMP COMPANY 1523 North Fremont Street Chicago 22, Illinois

NEW CATALOGS

Copper and Brass Technology

A 63-page booklet, "Fundamental Characteristics of Revere Metals," gives, in non-technical language, the basic technology of copper, brass and bronze. Topics include copper and its alloys, cold working and hardness, annealing, corrosion, and specifications.—*Revere Copper and Brass Incorporated, 6500 E. Slauson Ave., Los Angeles, Calif.* 80

Gravity and Forced Air Fittings

Catalog 10 GAC combines descriptions and list prices of both gravity and forced air fittings in a 20-page booklet. Dimensions of fittings are based on nationally accepted standardization practices.—*Corbman Bros., 315-21 N. Seventh St., Philadelphia 6, Pa.* 81

Condensing Unit Selection

Standard practice in selection of Servel condensing units and balancing evaporators and control apparatus is outlined in a 16-page booklet with technical data on rating refrigeration units and selection of location of condensing equipment, refrigerant flow control, operating controls, etc.—*Servel Inc., Electric Refrigeration Div., Evansville 20, Ind.* 82

Flexible Metal Hose

A 68-page catalog (G-50) contains descriptions and specifications for standard types of flexible metal hose in a variety of metals. Sections on expansion joints, metal bellows, and various special assemblies are included.—*Chicago Metal Hose Corp., Maywood, Ill.* 83

Steel Boilers

Catalog 80, 23 pages, 3 colors, describes and illustrates Kewanee steel boilers for heating power and process steam. Both low pressure and high pressure lines are offered as well as water heaters and hot water coils. Engineering data and specifications applying to both mechanical and hand-fired boilers are tabulated. Installation drawings and cutaway models are shown.—*Kewanee Boiler Corp., Kewanee, Ill.* 84

Relief Valves

Bulletin 711 describes forged steel relief valves with dimensions, weights, design detail, and installation instructions.—*Edward Valves, Incorporated, East Chicago, Ind.* 85

Heating Appliances

A new and condensed version of the Dunham General Products Catalog of Heating Appliances, Bulletin No. 634B, 12 pages, 2 colors, describes and illustrates three types of unit heaters, a line of cabinet convectors, baseboard convectors, finned radiation, pumps, and steam specialties. Bulletin covers 36 different products with specifications, capacities and applications.—*C. A. Dunham Company, 400 W. Madison St., Chicago 6, Ill.* 86

Furnace for Basementless Homes

A 6-page brochure describes the International R-9 furnace for oil or gas, designed exclusively for basementless homes and featuring ducts cast in the floor and vented to registers at windows.—*International Oil Burner Co., 3800 Park Ave., St. Louis 10, Mo.* 87

Air Recovery

Bulletin No. 118, 16 pages, 3 colors, entitled "A Dream of Green Air," tells the story of a worried business man troubled by a vision in which the conditioned air in his building becomes the color of money as he watches it being lost. Using a narrative style and simple diagrams, the booklet points out that much of this lost air might be saved if minute quantities of contaminated odors could be removed and the air recirculated. Techniques of air recovery with activated carbon are described and illustrated.—*W. B. Connor Engineering Corp., 114 E. 32nd St., New York 16, New York.* 88

Boiler Water Conditioning

Technical paper No. 114 describes the water conditioning action of Corrogen, a recently developed product using catalyzed sodium sulfite. Chemical activity and test results of Corrogen applications are described with graphs and charts.—*W. H. & L. D. Betz, Gillingham and Worth St., Philadelphia 24, Pa.* 89

Shaded Pole Motors

A 3-color bulletin, No. 4000, illustrates the Raytheon Type 470 six-pole motor with ratings from 1/30 to 1/8 hp at 1100 rpm. Performance curves and dimension diagrams are included.—*Russell Electric Co., 4501 S. Western Blvd., Chicago 9, Ill.* 90

Dust Collectors

Bulletin No. 1428, a paper-bound looseleaf compilaton of data sheets and installation photographs describes the American Blower line of equipment for collecting dust. Facilities of the American Blower testing laboratories are illustrated, and manufacturing techniques described.—*American Blower Corp., Box 58, Roosevelt Park Annex, Detroit 32, Mich.* 91

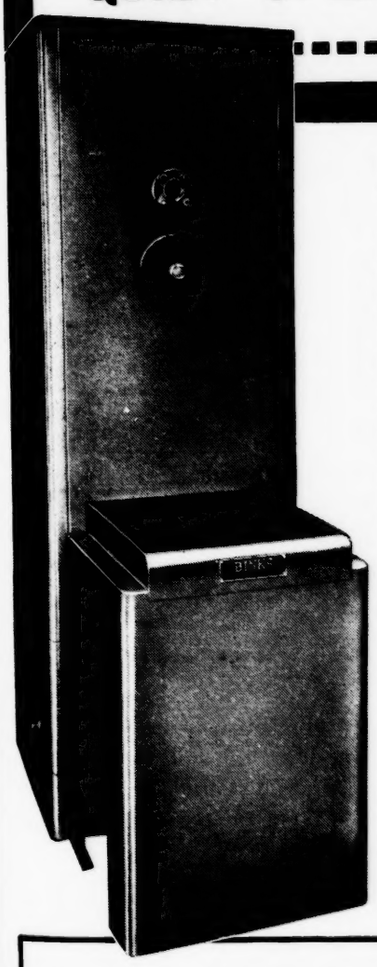
Foamglas Insulation for Houses

Technical data, photographs, charts, and diagrams are used in a brochure describing PC Foamglas in residential applications. Use of the material under concrete floors, masonry walls, roofs, sidewalks and driveways is described with physical and chemical data and sizes.—*Pittsburgh Corning Corp., 307 Fourth Ave., Pittsburgh 22, Pa.* 92

Residential Steel Boilers

Specifications, ratings, dimensions and engineering data on a new line of hand-fired residential steel boilers are combined in a new 4-page, 3-color catalog No. 538. Jacketed and cutaway views of the boiler are shown.—*The National Radiator Company, Johnstown, Pa.* 93

BINKS Type "B"
Forced Draft Cooling Towers give you maximum cooling efficiency
plus
QUIET OPERATION



Special slow speed, quiet operating blower assembly on Binks Type "B" Cooling Towers eliminates noise, making them ideal units for clubs, hotels, restaurants, homes or any inside installations. Also suitable for a wide variety of industrial processes where heat is liberated to circulating water. Cut water cooling costs to almost nothing . . . you can use the same circulating water over and over. Patented design of these towers greatly increases air-to-water ratio without increasing power consumption. The result is greater efficiency and less wear. Highly efficient where natural air movement is restricted . . . they create their own draft. Available in 34 standard sizes.

Send now for Bulletin No. 35. describing Binks type "B" Forced Draft Cooling Tower in full. State tower capacity required.

THERE'S A BINKS TOWER FOR EVERY COOLING JOB

Binks MANUFACTURING COMPANY

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REPRESENTATIVES IN ALL PRINCIPAL CITIES

for • SPRAYING
• WASHING
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YARWAY
SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

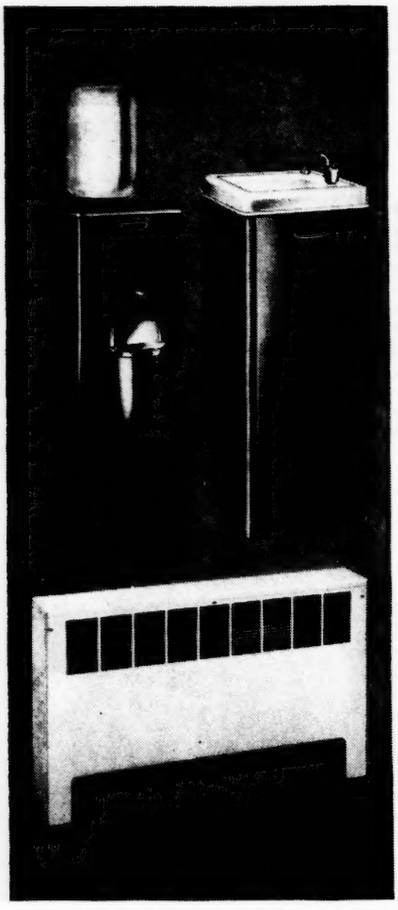
Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. - - Write for Bulletin N-616.

YARNALL-WARING COMPANY
104 Mermaid Avenue Philadelphia 18, Pa.

Announcing

fedders



ELECTRIC WATER COOLERS

● Backed by 17 years experience, Fedders Electric Water Coolers are designed for use with bottled water and for connecting to city water lines. Handsome cabinet, sanitary construction, quiet operation, compact size, — make them ideal for every installation. Write for data.

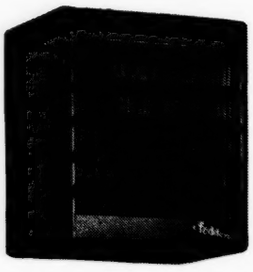
CONVECTOR RADIATORS

● Available in complete lines for semi-recessed, wall hung, and free-standing installations. High efficiency heating element with copper tubes and aluminum fins assures maximum heat transfer efficiency. Beautifully styled cabinets harmonize with modern decorative schemes. Ask for catalog.

Manufactured by Builders of Fedders Unit Heaters

● Thousands of industrial and commercial users depend on Fedders Horizontal and Downblow Unit Heaters. Design features include rugged cabinet, non-ferrous heating elements, full protection against expansion strains, modern broad blade fans and resilient motor mountings. Built in a complete line of well-graduated capacities. Write for catalog.

Also:
ROOM AIR CONDITIONERS
Window and Console Models
UNIT COOLERS
REFRIGERATION CONDENSERS
CLIP-ON SUPERHEAT THERMOMETERS
AUTOMOBILE RADIATORS
CAR HEATER CORES



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BUFFALO 7, N. Y.

Unit Heaters

Unit heaters, their appearance, construction, performance and application are the subject of Bulletin No. 638A, 2 colors, 14 pages, with 20 illustrations and 10 capacity tables.—*C. A. Dunham Company, 400 W. Madison St., Chicago 6, Ill.* 94

Water Cooling Equipment

Mechanical and natural draft cooling towers and a complete line of spray nozzles are described and illustrated in a looseleaf type full color catalog including data sheets, sizing and capacity tables, price lists, cutaway drawings, construction details, and installation photographs. Atmospheric spray cooling towers include items with redwood or steel louvers. Induced draft cooling towers, single fan or double fan, capacities from 3 to 300 gpm. Binks spray pond equipment, including piping, fittings, spray headers, feeder arms, nozzles, described with data for cost estimating. Air compressors and spray nozzles for humidifying operations with data on engineering design for various industries are included.—*Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago 12, Ill.* 95

Corrosion Resistant Valves

Circular No. 320, 32 pages, describes corrosion resistant valves and piping materials including fittings and pipe coils to meet a wide range of corrosive conditions.—*Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.* 96

High Pressure Steam Heater

Bulletin No. 109 describes the Niagara high pressure steam fan heater, a system of double coils using high pressure steam in the first coil and flash steam in the second.—*Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y.* 97

Air Conditioning Blower Units

Year 'round heating, cooling, humidifying or dehumidifying, filtering, and circulating blower units for comfort and industrial applications using any refrigerant are described in Bulletin No. 486, 14 pages, 3 colors, with sizing and capacity tables, dimension diagrams, specifications and engineering data, and so on.—*Kennard Corp., 1819 South Hanley Road, St. Louis 17, Mo.* 98

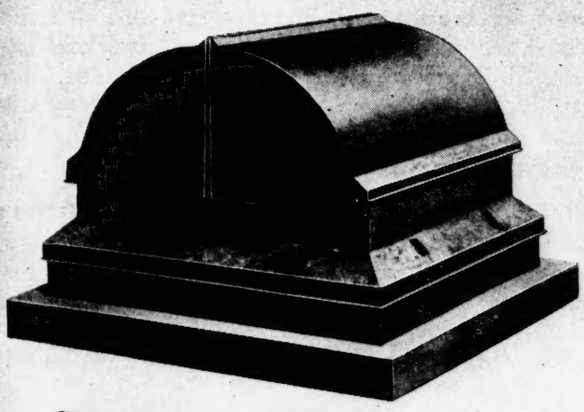
Refractories

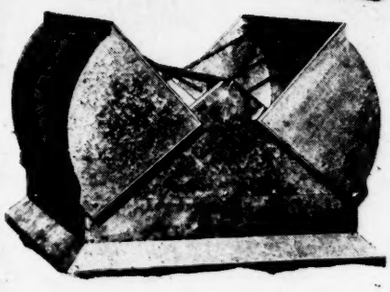
Bulletin R-22 covers refractory castables, plastics, and mortars with outlines of characteristics and typical applications for temperatures as high as 3100F. Photographs and tables of properties are included.—*The Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.* 99

Industrial Turbines

Bulletin B-3896, 20 pages, 2 colors, carries basic informaton on type E industrial turbines. Cutaway views show operating features. A sizing and selection guide is included.—*Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa.* 100

Factories use Ject-O-Valve for quick removal of heat and fumes





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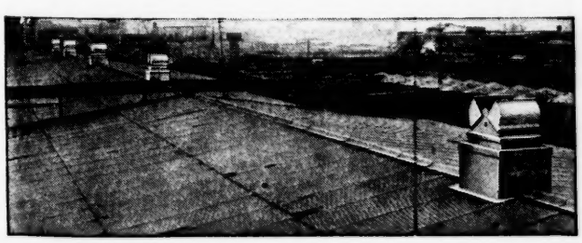

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A 4-page folder describes the modern U-4 sonic generator for production of sonic energy of high intensities to be used in dust and fume agglomeration and collecting systems. Performance data of the generator, frequencies from 500 to 22,000 cps and a resume of application experience are included.—*Ultrasonic Corp., 61 Rogers St., Cambridge 42, Mass.* 101

Electric Heating Elements

Strip, cartridge, and immersion electric heaters are described in a tab indexed looseleaf binder. Rating data, prices, dimensions and specifications are included on hot plates, air heaters, and control equipment.—*Industrial Engineering & Equipment Co., 711 S. Theresa Avenue, St. Louis 3, Mo.* 102

Refrigeration and Health

A 14-page, 2-color brochure, "To Your Health," opening a campaign to push refrigeration exports, shows pictorially the savings in money and resources resulting from refrigeration. The role of refrigeration in promoting national growth, industrialization, and security is portrayed.—*Air Conditioning and Refrigerating Machinery Association, Southern Bldg., Washington, D. C.* 103

New Cooling Towers

Bulletin AQ-49, 4 pages, 3 colors, describes and illustrates the new 7½-ton Aquatower, newest addition to the Marley line of packaged, all steel cooling towers. Features include grease-packed ball bearings, nail-less removable redwood filling, aluminum fan, galvanized hardware, etc. Bulletin includes engineering data and capacity tables.—*The Marley Co., Inc., Kansas City 15, Kansas.* 104

Heating Comfort Control

Sarcotherm controls for hot water heating systems are described from the consumer angle in a 16-page, 3-color brochure emphasizing simplicity of the indoor-outdoor Sarcotherm system. Colored illustrations and photographs illustrate operating principles and typical applications. Pages covering radiant heating control are included.—*Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.* 105

MAY, 1949

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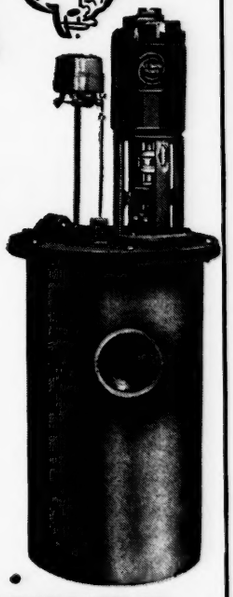

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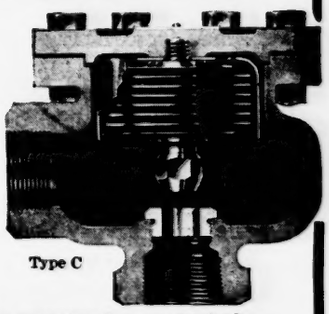

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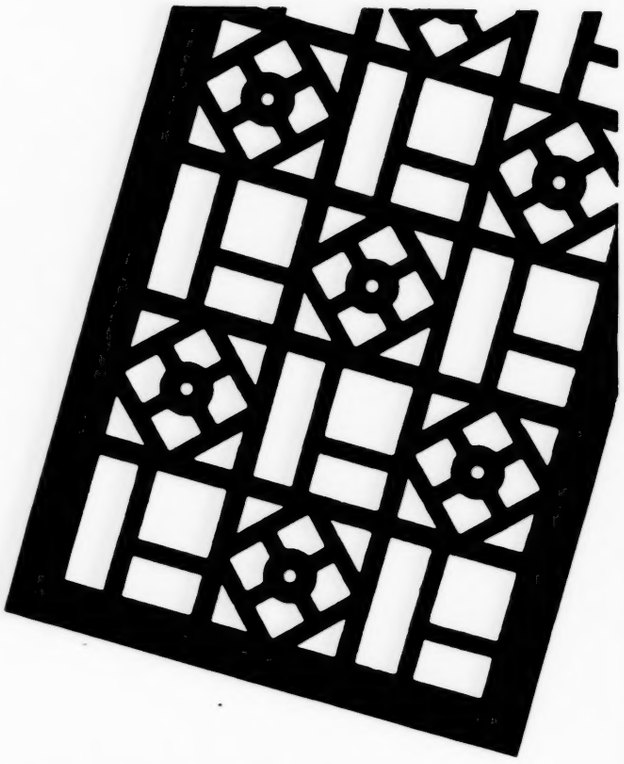

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Getting Personal

K. E. Sontag

K. E. Sontag *(It's Time to Service Your Cooling System*, page 67) has been with The Trane Company since 1935. Prior to that time, he served four years of an electrical apprenticeship and two years servicing and installing oil burners and other domestic heating equipment. Starting with Trane as a factory worker he gained experience in building heating and air conditioning equipment and then proceeded to the Trane laboratory as a technician. Here he learned much from the operation and testing of Trane equipment. In 1939 he became one of the company's first service men. He and his kit of tools have traveled from coast to coast handling heating and air conditioning service for Trane.

Between 1942 and 1945 he was a master sergeant with the army in the Pacific theater. His army work took him further into refrigeration service work, since he was called on to repair numerous cold storage installation on Pacific island bases.

He returned to The Trane Company in 1946 and resumed his work as service engineer with headquarters in La Crosse. In October, 1947, Mr. Sontag, at 31, was appointed service manager for the company. Under him at the present time are 15 service men stationed in cities from coast to coast.

C. A. Rackey (co-author, *Air Conditioning a Television Studio Plant*, page 57) has been for over 20 years associated with the National Broadcasting Company in plant and systems engineering for sound and television. He was in charge of design and installation of technical and mechanical equipment for all NBC studio plants in seven major cities throughout the U.S.A., including the network headquarters at Radio City, New York. At present he is manager of Audio-Video Engineering for NBC, with air conditioning one of his many responsibilities and interests.

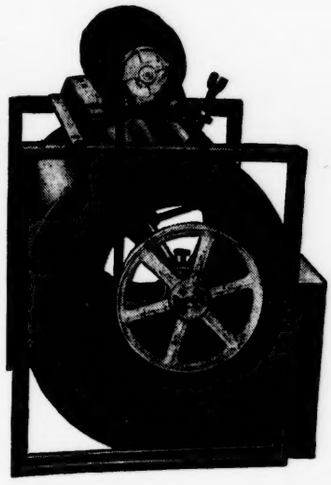
Mr. Rackey attended Rensselaer Polytechnic Institute, and Brooklyn Polytechnic Institute, is a senior member of the Institute of Radio Engineers and executive vice president of the Audio Engineering Society. For research reference in air conditioning, he spends week-ends on a power cruiser on Long Island Sound where the comfort cooling (generally) is salubrious.

C. A. Rackey

R. T. Keowen

R. T. Keowen (co-author, *Air Conditioning a Television Studio Plant*, page 57) joined the Audio-Video Engineering group at NBC in 1946, specializing in the problems of air conditioning and other mechanical facilities associated with radio and television broadcasting. In late 1949 he was promoted to head up operations of the extensive NBC air conditioning plant at Radio City.

Prior to his association with NBC, Mr. Keowen was assistant air conditioning engineer for Metropolitan Life



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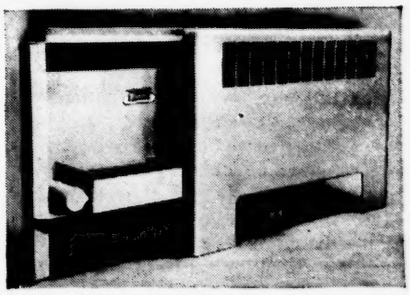

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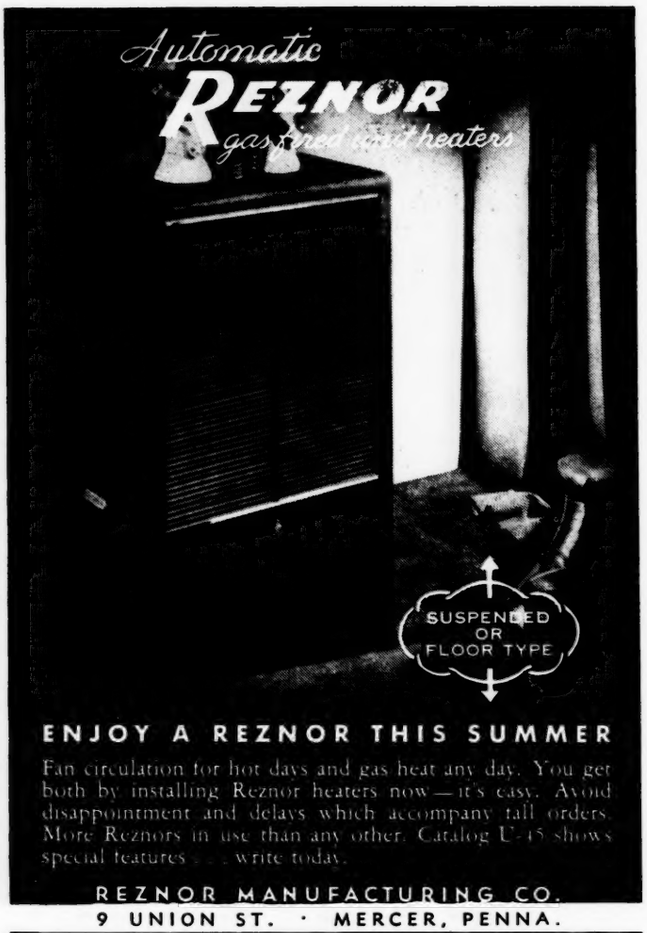

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Alliance Motors have these outstanding advantages:

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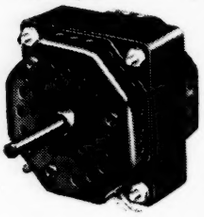
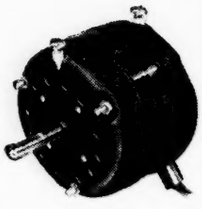
Alliance builds 4-pole and 6-pole shaded pole induction motors with speeds from 500 to 1550 rpm and from 1/100 h.p. up to 1/25th h.p. Smaller 2-pole shaded pole motors will supply as little as 1/400 h.p.

MODEL B
4-pole shaded pole motor. Approx. 1/30 h.p. 1550 r.p.m.





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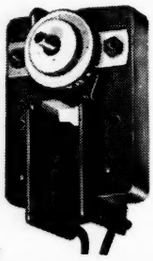
2-pole shaded pole motor — full load h.p. .0021. Full load 2800 r.p.m.



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in New York, which tenure was interrupted by a four-year hitch with the AAF. He was post engineer at New Castle Army Air Base with rank of captain.

He is a graduate of Stevens Institute of Technology and has taken postgraduate work in heating, ventilating and air conditioning at Stevens and at Pratt Institute. He lives at Glen Head, Long Island, and puts in a large portion of his time in Air Force Reserve activities.

R. L. Linforth

R. L. Linforth *(Air Recovery in Aircraft Cabin Conditioning*, page 62) completed three years in mechanical engineering at Montana State College and one year of aeronautical engineering at the University of Washington in Seattle. His schooling was finished at the Boeing School of Aeronautics at Oakland, California, in 1935. After a period of employment at Consolidated Aircraft Company, he joined the engineering division of the Boeing Aircraft Company, Seattle, Washington, where his assignments have been directly connected with design and development of cabin air and altitude conditioning systems. Recent assignments include supervision of design, installation, and flight testing of air and altitude conditioning systems and thermal surface anti-icing systems on the Stratocruiser, Stratofreighter, B50 Super Fortress, and classified preliminary design projects. He is a member of the National Advisory Committee for Aeronautics' subcommittee on aircraft icing problems.

. . . Since the Last Issue

B. E. James

Byron E. James has been appointed chief engineer of **McQuay, Inc.**, Minneapolis, manufacturers of heating, air conditioning and refrigeration equipment. Mr. James came to McQuay from The Liquid Carbonic Corp., Morrison, Ill., where he held the positions of chief engineer and general manager. A 1932 graduate of the Massachusetts Institute of Technology, Mr. James was with York Corp., York, Pa., until the spring of 1947. He joined York as a student engineer and had advanced to manager of equipment development at the time of leaving the organization to go with Liquid Carbonic. With McQuay he assumes responsibilities of new product development, present product improvement and application, production inspection and patents.

The newly formed **Avery Products Co.**, 1908 Euclid Ave., Cleveland 15, Ohio, will take over the sale of air conditioning units and other special items formerly sold by the Merchandise Department of the **Avery Engineering Co.** Officers of the Avery Products Co. are: **Lester T. Avery**, president; **Dwight E. McLean**, vice president; **Joseph E. Wilhelm**, treasurer; **Ethel Barnes**, secretary. The separation of this business from the Avery Engineering Co. was made to better cover specialty selling fields and to concentrate the Avery Engineering Co. on commercial and industrial work in air conditioning and refrigeration.

Fidelco, Inc., 207 E. 37th St., New York City, has become a major distributor for **United States Air Conditioning Corp.'s** packaged air conditioning sales division.

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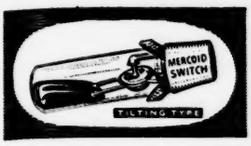
AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS



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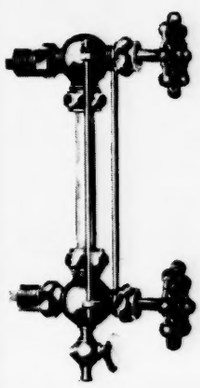

For decades Roberts Water Gauges have been a standard of quality wherever tubular glass gauges are used.

Modern design—made of solid brass with plenty of strength. Self-cleaning feature keeps lower part of gauge from clogging with scale. Special packing allows free expansion of glass, avoiding breakage.

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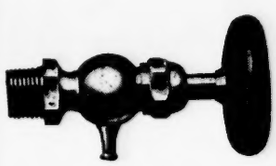
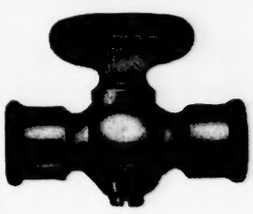


Solid brass, durable, with seats that stand long use. Model shown has stuffing box.

Also offered in light pattern less stuffing box.

AIR COCKS—STEAM GAUGE COCKS



Roberts makes air cocks of all types and steam gauge cocks for pressure gauges.

All sizes – 1/8" up to 1/2".

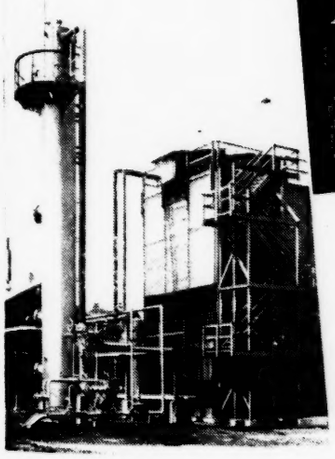
Write for information on Roberts Gauges and Cocks.

THE ROBERTS BRASS MANUFACTURING CO.

Manufacturers of Brass Goods for Steam, Water, Gas and Air

5435 WEST FORT ST. • DETROIT 9, MICH.

Pritchard COOLING TOWERS



Thoroughly Engineered* ...Adequately Sized

THREE LEADING LINES
Cooling Towers
Heat Exchangers
Gas Equipment for
FIVE MAJOR FIELDS
Chemical, Natural Gas, Petroleum, Power and Refrigeration.

J.F. Pritchard Co.

*For Longer Life and Trouble-Free Performance

EQUIPMENT DIVISION
908 Grand Ave., Kansas City 6, Mo.

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Representatives in Principal Cities

J.F. Pritchard & Co.

ENGINEERS • CONSTRUCTORS • MANUFACTURERS
for the CHEMICAL, PETROLEUM, GAS & POWER industries

AIR-FLO

AUTOMATIC

CEILING SHUTTER

FOR ATTIC FAN

Built so they can be installed practically flush with the ceiling, AIR-FLO Ceiling Shutters present a refined, finished appearance. Their natural aluminum color blends with any decoration, eliminating need for painting, and no grille or winter cover is required. Furnished in 5 different widths, single panel up to 73" long. No operating mechanism shows. Built-in fusible link. Meets fire underwriters requirements.

WRITE FOR NEW CATALOG 43-F

Illustrations and details of the complete AIR-FLO line.

AIR CONDITIONING PRODUCTS CO.

2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

Solenoid

STAINLESS STEEL

Valves

ACTUAL SIZE

★ Standard pressure range, 5 to 250 psi
★ Dimensions 2¾" high x 1⅝" dia.
★ Impregnated coils withstand moisture and condensation
★ Soft insert seats prevent leakage
★ Spring loaded for positive action
★ Stainless steel parts highly resistant to corrosion and wear
★ Power consumption 10 watts max.
★ Pipe connections to specification
★ Also many special valves for handling pressures from 5 to 850 psi

THREE WAY - TWO POSITION
TWO WAY - NORMALLY CLOSED
TWO WAY - NORMALLY OPEN

Skinner will be pleased to make recommendations on your particular design applications — they have for hundreds of others. Write today for details and catalog.

SKINNER ELECTRIC VALVES

Skinner ELECTRIC VALVE DIV.

THE SKINNER CHUCK COMPANY

136 Belden Ave., Norwalk, Conn.

After several years as sales manager of the Janitrol Domestic-Commercial Heating Division of Surface Combustion Corp., Toledo, Ohio, Eugene A. Weaver is leaving to establish his own business. His company, to be known as the Weaver-Janitrol Company, with offices in the Boulevard Building, 7310 Woodward Avenue, Detroit, Michigan, will distribute Surface Combustion and Webster heating equipment throughout the state of Michigan.

R. A. Bell

Concurrent with the announcement of Eugene A. Weaver's leaving **Surface Combustion** to establish his own business, C. B. Phillips, vice president of the company, stated that the responsibility of general sales management of the Janitrol divisions—the aircraft-automotive heating division and the domestic-commercial heating division—would be combined under one head with sales managers for each of the two individual divisions. **Robin A. Bell** has been advanced to general sales manager of both divisions. Mr. Bell was formerly eastern regional manager and assistant sales manager of the domestic-commercial division—and for the past several years sales manager of the aircraft-automotive division. **Harry C. Gurney,** western sales manager, domestic-commercial heating division, will advance to sales manager of this division. Mr. Gurney directed Janitrol district sales in the eastern area prior to becoming western sales manager. He will move from Chicago to the Toledo general office of the company. **William J. Grover,** marketing director for all sales divisions of Surface Combustion, will devote an increased portion of his time to market research and retail sales planning activities for the domestic-commercial heating division. **Russell W. Glenn,** of the aircraft-automotive division, has been advanced to sales administration manager of the new combined Janitrol divisions. **James W. Ashby,** of the aircraft-automotive division, will become sales manager of this division. He will remain at the Columbus, Ohio, plant of the company.

J. W. Ashby

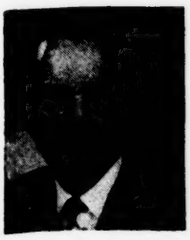
H. C. Gurney

R. W. Glenn

W. J. Grover

C. A. Dunham Company, manufacturer of heating systems and products, has completed a one-story addition to its Michigan City, Ind., factory. The new building is of concrete block construction, 170 x 120 ft in plan, and located adjacent to the company's present plant. The need for expanded facilities has been occasioned by growing sales of the company's products.

Part of the new building will be used for the storage of finished products just prior to shipment, and the balance will house the order and billing departments which are being transferred from the company's headquarters in Chicago. The new building will be served by a switch track of the Nickel Plate Railroad. In addition, special ramps will permit the quick loading of truck shipments.



E. W. P. Smith

Appointment of E. W. Pat Smith as special assistant to the general sales manager of Owens-Corning Fiberglas Corp., has been announced. Until recently Mr. Smith was vice president for sales of Philip Carey Manufacturing Co. Previously he served in various sales capacities with the Johns-Manville Corp. and Certain-teed Products Corp. Mr. Smith is president of the Asbestos-Cement Products Association, past chairman of the board of governors of the Asphalt Roofing Industry Bureau, a committeeman of the Producers' Council, and a director of the National Mineral Wool Association. A member of the American Society of Civil Engineers, he is a graduate of the University of Illinois. Mr. Smith will work with Owens-Corning's branch offices and sales divisions on the distribution of Fiberglas products into industrial, building, and related fields.

Recent changes in the advertising department of Dravo Corp., Pittsburgh, include the appointments of Thomas M. Fallon as manager of advertising for the Machinery Division; George J. Newhams, manager of advertising for the Engineering Works Division, and Edward P. Pearsall, manager of corporation publications. The department is headed by William H. Collins, director of advertising.

R. C. Vroom

Peabody Engineering Corp., New York, N. Y., announces the appointment of **Robert C. Vroom** as executive advisor and consultant. Mr. Vroom is a graduate of Stevens Institute of Technology with the degree of M.E. and is the inventor of many devices relating to the combustion of fuels and allied subjects. For many years as chief engineer he has been identified with the new development work of the company as an authority in this special field. Mr. Vroom will now concentrate on all phases of the company's activities with particular attention to planning, procedure and overall policy and will have his headquarters at 580 Fifth Ave., New York City.

Super Radiator Corp., manufacturers of light weight extended surface for heating and cooling, celebrated its twentieth anniversary with the opening of a new office and factory building in St. Louis Park, Minneapolis, Minn., and announced an expanded sales program to distribute their products nationally through factory representatives located in principal cities.

United States Air Conditioning Corp. announces that **J. M. Oberc, Inc.** of Detroit, Michigan has been appointed exclusive distributor for the usAIRco line of packaged air conditioning units in Southeastern Michigan.

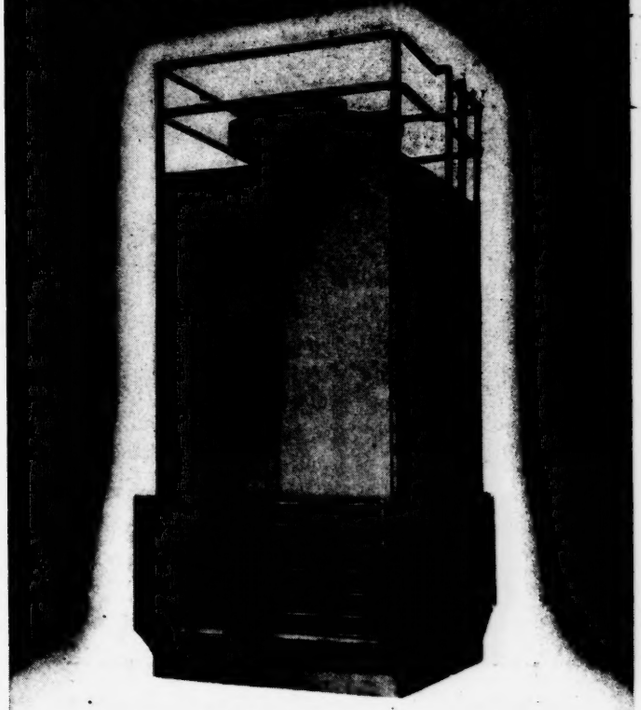
J. G. Wilsey

Wilson & Co., Inc., announces the promotion of **John G. Wilsey** as manager of hair filter sales, effective April 1, 1949. This is a subdivision of the Wilson Hair Products Division, headed by Mr. Charles W. Becker, vice president. Mr. Wilsey joined the Hair Filter staff on November 1, 1948, coming from the Winchester Repeating Arms Co.'s Electrical Division, where he served as sales supervisor. Mr. Wilsey has been associated with the heating and ventilating industry for many years, beginning with furnace installations in 1932. Later, he worked as a jobber and dealer salesman and eventually managed a heating and ventilating business of his own. Mr. Wilsey completed various business and technical subjects both in the commerce and engineering colleges of Northwestern University, of which he is a graduate.

NEW MARLEY *Verflow**

An "*Extra Quality*" Tower

. . . At No Extra Cost



The New Marley VERFLOW sets a new standard in air conditioning and refrigeration Cooling Towers.

Check these "extra quality" features formerly found only on heavy duty, industrial cooling towers that are now available on all Marley wood or steel VERFLOWS at no extra cost to you . . .

√ Lifetime nail-less filling. √ Filling that can be removed and reinstalled in a matter of minutes. √ Totally enclosed motors. √ Enclosed bearing housings with grease packed bearing. √ Marley air-foil section cast aluminum alloy fans. √ Special corrosion-resistant paint on metal towers. √ Heavy double-sheathed wood casing on wood towers. √ Patented, close-centered Marley jet action spray nozzles in balanced distribution system. √ Hinged louver frames and removable louvers. √ Quickly erected, easily operated with little maintenance time.

These and other "extra quality" features make Marley VERFLOW the best buy on the market. Many special accessories such as Geareducer drive, handrail and ladder are also available at a small added cost.

Ask your nearest Marley representative to tell you more about the VERFLOW or write for Bulletin V-49.

MARLEY COOLING TOWERS

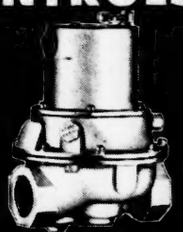
*VERFLOW is the exclusive trademark of

THE MARLEY COMPANY, INC.

Kansas City 15, Kansas

GENERAL CONTROLS

SILENT *Electric Diaphragm* GAS VALVE



Designed for reliable control of natural, manufactured, mixed and liquefied petroleum gases to space and unit heaters, central, floor and wall furnaces and boilers.

Designated the B-50, this valve has no packing glands or bellows to impede operation. Low current consumption of 5 watts. For low or line voltage applications. Standard model or manual opening model with or without electric trip. Envelope size of valve makes it easy and simple to adapt to any gas-fired heating installation. Packless construction. All body parts die formed aluminum of high density and tensile strength.

Also available in packaged sets which include the new B-50 valve, a compact, modern, snap-action Thermostat (stainless cover with ivory plastic base, extending only 1" from wall), a 9 V A Transformer and thermostat cable.

Many leading furnace manufacturers specify GENERAL CONTROLS as standard equipment and *all* gas-heating appliances are available with these outstanding control units.

If they're GENERAL CONTROLS, they're the BEST

GENERAL CONTROLS

801 ALLEN AVENUE GLENDALE 1, CALIF

Manufacturers of Automatic Pressure, Temperature, Level & Flow Controls

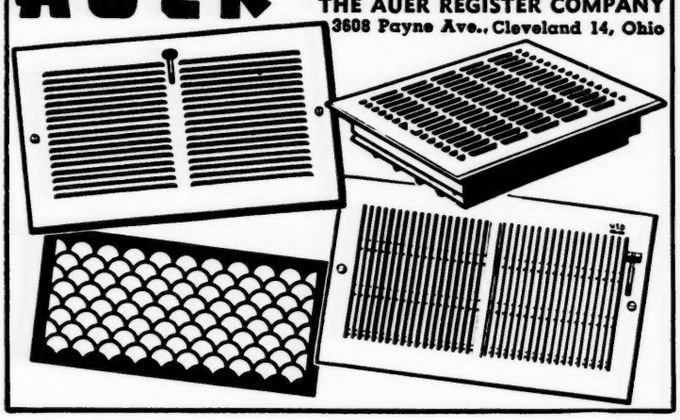
FACTORY BRANCHES BIRMINGHAM (3) BOSTON (16) CHICAGO (5) CLEVELAND (15) DALLAS (2) DENVER (10) DETROIT (8) GLENDALE (1) HOUSTON (6) KANSAS CITY (2) NEW YORK (17) OKLAHOMA CITY (1) PHILADELPHIA (40) PITTSBURGH (22) SEATTLE (1) SAN FRANCISCO (7) ST. LOUIS (12) DISTRIBUTORS IN PRINCIPAL CITIES

57-4

AUER REGISTERS & GRILLES

THE AUER REGISTER COMPANY

3608 Payne Ave., Cleveland 14, Ohio



ORIGINATORS OF

ELECTRONIC

CONTROLS FOR HEATING SYSTEMS

AU-TEMP-CO

MOTORIZED VALVES

INDOOR-OUTDOOR TEMPERATURE CONTROLS

Au-Temp-Co Corp., 521-5th Ave., N.Y.C.

C. W. Farrar

Cecil W. Farrar has been appointed general manager of sales for the **Richmond Radiator Co.,** an affiliate of Reynolds Metals Co. Mr. Farrar, formerly president of the Excelso Products Corp., joined Richmond as sales manager of the plumbing division in September, 1944, and in March of 1948 was appointed director of sales promotion for all Richmond products. He will make his headquarters at the Richmond Radiator general sales offices which are located at 19 East 47th Street, New York City.

Operations of the **Ingersoll Utility Unit Division of Borg-Warner Corp.** are being suspended, according to **Charles R. D'Olive,** vice president and general manager of the division, who said that "this action is due to increasing uncertainties in the overall housing picture, together with the immediate demand for minimum units of types that the division is not prepared to fabricate. It was indicated that the clean-up of the existing backlog of orders will be completed early in June, at which time production at the Division's plant in Evansville, Ind., will be discontinued. The Utility Unit Division has been manufacturing packaged units consisting of furnace, water heater, bath, and kitchen, together with plumbing waste and vent systems, for small houses.

Walter V. Davidson, Jr., has been appointed assistant to the president of **W. B. Connor Engineering Corp.,** New York, manufacturers of activated carbon air purification equipment and adjustable ceiling air diffusers. Prior to joining the Connor Corporation he was associated with the management engineering firm of Stevenson, Jordan & Harrison, Inc.

Dr. Willis Haviland Carrier, chairman emeritus of **Carrier Corp.,** was honored at a testimonial dinner in Syracuse, April 13, by the North American Branch of the Newcomen Society of England as "the Father of Air Conditioning." Leaders of industry, finance, commerce and science from various parts of the United States and Canada were in attendance. Newcomen is an honorary society which honors persons who have contributed or are contributing to the material progress of mankind. Others recognized by Newcomen in recent years include Thomas Alva Edison, Cyrus H. K. Curtis, J. J. Bausch, John D. Rockefeller, Sr., and Daniel Willard.

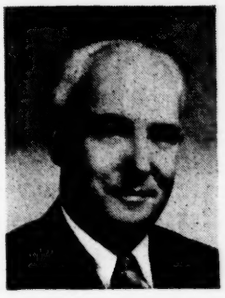
A plant consisting of industrial buildings containing 90,000 sq ft located on an eight-acre tract at Mt. Vernon, Illinois, has been purchased by **Wagner Electric Corp.** of St. Louis. The company is concentrating its facilities for building transformer tanks at the new plant.

T. S. Pendergast

Baker Refrigeration Corp.'s board of directors has elected **T. S. Pendergast** as a director and president of Baker's entire operations. Mr. Pendergast has held the position of general manager at Baker for the past six months. The Baker Refrigeration Corporation is a member of the Equity Group. At the present time, the Securities and Exchange Commission is being asked to approve a plan whereby the Baker Refrigeration Corp. would be acquired by the Bell Aircraft Corp. of Niagara Falls, New York. This would be accomplished by a stock transfer within the Equity Group. Baker stock now held by the First York Corp. would be acquired by Bell Aircraft. In exchange, First York would receive shares of a newly created issue of Bell preferred stock and additional shares of Bell common stock beyond the approximately 35% of Bell common now held by First York.

Richard J. Seltzer, age 36, has been appointed production manager for all plants of the **Bryant Heater Division, Affiliated Gas Equipment, Inc.** Mr. Seltzer has been associated with Bryant since May, 1948, serving in an advisory capacity at the Tyler, Texas, plant. Previously he was with Rheem Manufacturing Co., having served since 1938 in various capacities and finally, from April, 1947 to May, 1948, he was manager of Rheem's eastern plants (Bayonne, Baltimore, Chicago, Birmingham, New Orleans and Houston) in charge of manufacturing and operations. He graduated as a commercial mechanical engineer from Washington State College in 1935.

Appointment of **T. W. Milligan** as manager of the central sales division of the **Pyle-National Co.** with headquarters in Chicago, and **James V. Baker** as assistant manager of the division with headquarters in Cleveland is announced. Mr. Milligan became associated with the company in the latter



J. V. Baker

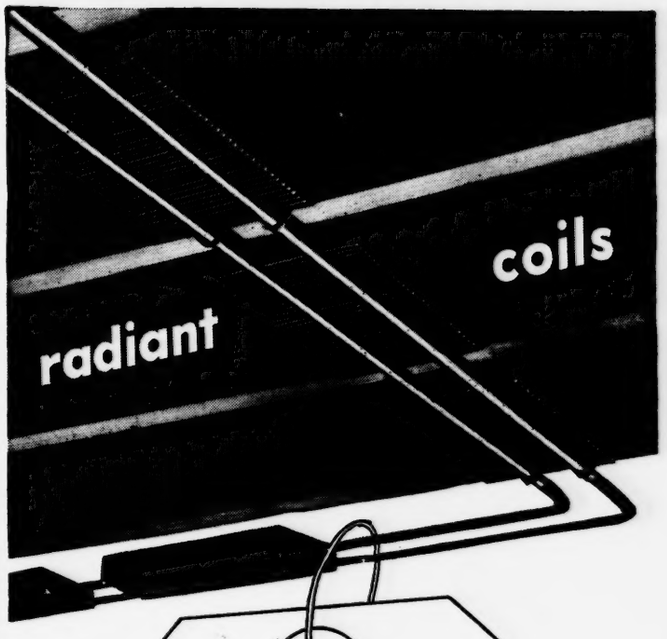
T. W. Milligan

part of 1945. After two years in the St. Paul office he was appointed manager of the western division. Mr. Baker joined the company in 1919 as a sales and service engineer. For years he handled general special assignments covering the United States. For the last six months he has been assisting in the organization of the central sales division.

Harry W. Ellis of Milwaukee, chairman of the board of **Johnson Service Co.**, Milwaukee, manufacturers of automatic temperature and air conditioning control systems, died on April 7 after a brief illness. He was 84. Mr. Ellis remained active in his post as board chairman following his partial retirement in 1938 after serving 25 years as president and general manager. Entering the employ of the *Evening Wisconsin* at a relatively early age, he was a salesman of advertising space when he was employed, in 1894, by Warren S. Johnson, founder and first president of the company to which the deceased devoted the rest of his life. After a period of years as the manager of the Johnson Company's interests in Chicago, Mr. Ellis was called back to Milwaukee, upon the death of Mr. Johnson in 1912, to become the second president of the company and to assume also the duties of general manager. When Mr. Ellis elected to resign as president and general manager, after 25 years in that position, he was prevailed upon to accept the post of chairman of the board of directors, which was created for him.

INDUSTRIAL DEGREE-DAYS
March, 1949

City	55F Base	45F Base
Baltimore, Md.	314	123
Buffalo, N. Y.	653	381
Chicago, Ill.	512	258
Cleveland, Ohio	560	322
Detroit, Mich.	600	343
Indianapolis, Ind.	453	241
New York, N. Y.	422	195
Philadelphia, Pa.	369	162
Pittsburgh, Pa.	442	244
St. Louis, Mo.	371	175



an easier way to get your B.T.U.'s

Kritzer Radiant Heating is so simple it can be packaged in units—so complete it can be cataloged, (see below) to fit any arrangement—*ready to install.* Compare this with what you do now. Kritzer Finned Radiant Coils can be figured and installed in ½ the time and with ½ the cost.

You order the amount of coil runs needed—as soon as the structural frame is up, you put them in. *Two men in a few hours can handle the whole layout right up to the pump manifold.* No extras—no additional parts—no callbacks.

Kritzer Radiant Coils consist of ⅝", 3" center, copper tubing with mechanically bonded, maximum heat radiating, aluminum fins. They are fabricated to fit between joist and stud spacings of 12", 16" and 24". A permanent installation that will last as long as the building.

WRITE TODAY FOR COMPLETE DETAILS AND CATALOG

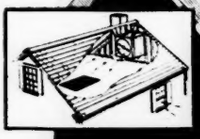
FOR JOISTS	FINNED LENGTH	SPACE BETWEEN FINNED SECT.	OVERALL LENGTH EACH COIL	CARTON		OVERALL LGTH. OF COILS IN CARTON
				NO. OF COILS	SHIP. WT. APP.	
12" O.C.	8"	4"	120½"	8	125 lb.	80⅓'
16" O.C.	12"	4"	112½"	8	120 lb.	75'
24" O.C.	18"	6"	120½"	8	125 lb.	80⅓'

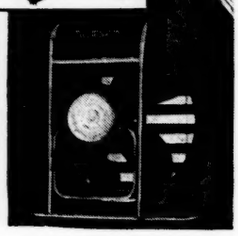
KRITZER RADIANT COILS
2907 Lawrence Avenue • Chicago 25, Illinois

"IF IT'S KRITZER, IT'S RIGHT SIR"

COMFORT Guaranteed!

YOU WILL PROFIT BY THESE EASY-TO-SELL, EASY-TO-INSTALL HOME FANS





TYPE EV
Popular spring mounted package unit for horizontal attic floor installation. Complete with all equipment and accessories for quick installation. 5 sizes 24" to 48". 4700 to 15000 CFM.

TYPE EH
Brand new spring mounted package unit for vertical attic installation. Easy to install with minimum building alteration. 9 models from 24" to 60" 5000 to 25000 CFM.

ALSO 4 *NEW* WINDOW FAN MODELS FOR QUICK "OVER-THE-COUNTER" SALES!

Sizes from 12" to 30"—single and variable speeds. Ideal for installation where permanent Comfort Coolers are less adaptable. 1000 to 8200 CFM.

WRITE FOR CATALOG 863 describing Window Fans and the complete line of Comfort Coolers from 24" to 60"

CHELSEA FAN & BLOWER CO.
INCORPORATED
1206 GROVE STREET, IRVINGTON 11, NEW JERSEY

Make the Roof Perspire for You!

***Use* RUPPRIGHT'S ROTARY ROOF COOLER**

A Boon to Air Conditioning

Reduces load, cuts power consumption by elimination of solar heat through evaporation of thin film of water continuously renewed without thermostat or electrical connection. Ask for bulletin giving detailed cost and performance data!

TERRITORIES OPEN

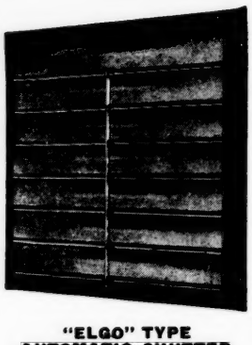
Write to: BOX 6795, LOS ANGELES 22, CALIF.

Elgo Ventilating Specialties

Quick-Operating Automatic Shutter

A shutter that opens the instant the air current starts, and closes tight when the air current stops. No flapping or fluttering in between-times. Weather-stripped so that louvers fit snugly. Sizes 8" to 72" square—also rectangular.

Prompt Shipment of Standard Sizes



"ELGO" TYPE AUTOMATIC SHUTTER
Front View (Closed)

Free CATALOG

ELGO SHUTTER & MANUFACTURING CO.
2738 W. Warren Detroit 8, Mich.

Canadian Degree-Days for March, 1949*

City	March		Cumulative, Sept. 1 to Mar. 31	
	1949	Normal	1948-49	Normal
Calgary, Alta.	1197	1215	8401	7881
Charlottetown, P.E.I.	1141	1203	6384	6869
Crescent Valley, B. C.	961	961	7284	6704
Edmonton, Alta.	1237	1290	9113	8589
Fort William, Ont.	1401	1386	8263	8590
Grande Prairie, Alta.	1383	1339	9754	8795
Halifax, N. S.	973	1066	5536	6134
London, Ont.	1054	1073	5782	6326
Medicine Hat, Alta.	1091	1150	8154	7588
Moncton, N. B.	1135	1190	6689	7296
Montreal, P. Q.	1189	1265	6374	7373
North Bay, Ont.	1432	1280	7558	7933
Ottawa, Ont.	1259	1256	6721	7638
Penticton, B. C.	862	787	6482	5566
Porquis Junction, Ont.	1621	1550	8636	9614
Prince George, B. C.	1135	1091	8647	7768
Quebec City, P. Q.	1209	1311	6810	7999
Regina, Sask.	1448	1504	9684	9641
St. John, N. B.	1073	1132	6111	6784
Saskatoon, Sask.	1426	1445	9778	9356
Toronto, Ont.	1001	1072	5289	6226
Vancouver, B. C.	685	682	5098	4479
Victoria, B. C.	617	651	4488	4065
Windsor, Ont.	905	961	5123	5872
Winnipeg, Man.	1525	1531	9287	9622

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

OIL BURNER SHOW—National Oil Heat Exposition and annual convention, at Mechanics Hall, Boston, Mass. Sponsored by Oil-Heat Institute of America, Inc., 6 E. 39th St., New York 16, New York. .....**MAY 16-20, 1949.**

OHI OLD TIMERS' MEETING—Annual dinner meeting of the Old Timers' Club of the oil burner industry, at the Coral Gables, N. Weymouth, Mass., during Oil-Heat Institute exposition and convention, F. B. Caldwell, secretary, 64 E. Jackson Blvd., Chicago 4, Ill. .....**MAY 17, 1949.**

STEAM SPECIALTY MEETING—Annual meeting of the National Steam Specialty Club, at Skytop Lodge, Skytop, Pa. J. M. Naab, vice president, Leslie Co., Lyndhurst, N. J. ..**MAY 18-20, 1949.**

SMOKE PREVENTION CONFERENCE—42nd annnual conference, Smoke Prevention Association of America, Inc., at Birmingham, Ala. D. A. Sullivan, public relations director, 72 W. Adams St., Chicago 90, Ill. .....**MAY 23-27, 1949.**

NDHA MEETING—Annual meeting, National District Heating Association, at The New Ocean House, Swampscott, Mass. John F. Collins, Jr., secretary of Association, 827 N. Euclid Avenue, Pittsburgh 6, Pa. (For detailed program, see page 108). .....**MAY 24-27, 1949.**

PLUMBERS CONVENTION AND SHOW—1949 convention and exposition of the National Association of Master Plumbers, at Cleveland Public Auditorium, Cleveland, Ohio. Secretary of Association, 1106 K St., N.W., Washington 5, D. C. .....**MAY 30-JUNE 2, 1949.**

ASRE MEETING—36th spring meeting, American Society of Refrigerating Engineers, on the Steamer Richelieu, from Montreal, Quebec, for the Saguenay River cruise. M. C. Turpin, secretary of the Society, 40 West 40th Street, New York, N. Y. (For detailed program, see page 108)....**JUNE 5-9, 1949.**

AUTOMOTIVE ENGINEERS MEETING—Summer meeting, Society of Automotive Engineers, at French Lick Springs Hotel, French Lick, Ind. John A. C. Warner, secretary of Society, 29 W. 39th St., New York 18, N. Y. .....**JUNE 5-10, 1949.**

CONTRACTORS CONVENTION — 60th annual convention, Heating, Piping & Air Conditioning Contractors National Association, at Hotel Statler, Detroit, Mich. Joseph C. Fitts, secretary of Association, 1250 Avenue of the Americas, New York 20, N. Y. .....**JUNE 8-10, 1949.**

STOKER MEETING — Annual meeting, Stoker Manufacturers Association, at French Lick Springs, Ind. Headquarters not announced. Marc G. Bluth, executive secretary of Association, 307 N. Michigan Ave., Chicago 1, Ill. .....**JUNE 13-14, 1949.**

I-B-R SHORT COURSE—Third I-B-R short course on steam and hot water heating systems, sponsored by the University of Illinois and I-B-R, on the university campus at Champaign-Urbana, Ill. .....**JUNE 14-17, 1949.**

ASHVE MEETING—Semi-annual meeting, American Society of Heating and Ventilating Engineers, at Hotel Nicollet, Minneapolis, Minn. A. V. Hutchinson, secretary, 51 Madison Ave., New York, N. Y. .....**JUNE 20-22, 1949.**

WARM AIR CONVENTION — Mid-year convention of the National Warm Air Heating and Air Conditioning Association, at Edgewater Beach Hotel, Chicago, Illinois. Managing director, George Boeddener, 145 Public Square, Cleveland 14, Ohio. .....**JUNE 21-22, 1949.**

HEAT TRANSFER MEETING—2nd annual meeting of the Heat Transfer and Fluid Mechanics Institute, on the campus of University of California, Berkeley, Calif. Director, Department of Institutes, University of California, Berkeley 4, Calif. .....**JUNE 22-24, 1949.**

INSTRUMENT CONVENTION—1949 convention of the Instrument Society of America, at Municipal Auditorium, St. Louis, Mo. John McCaffery, assistant executive secretary of Society, 1117 Wolfendale St., Pittsburgh 12, Pa. .....**SEPTEMBER 12-16, 1949.**

PLUMBING AND HEATING MEETING — Annual meeting of the Plumbing and Heating Industries Bureau, at Palmer House, Chicago, Ill. Norman J. Radder, secretary of Bureau, 35 E. Wacker Dr., Chicago 1, Ill. .....**OCTOBER 5, 1949.**

WELDING AND METALS MEETING—1949 Annual Meeting of the American Welding Society, in conjunction with the National Metals Congress, tentatively at Cleveland Hotel, Cleveland, Ohio. Secretary of Society, 33 W. 39th St., New York 18, N. Y. .....**OCTOBER 16, 1949.**

AGA CONVENTION—1949 annual convention, American Gas Association, at Chicago, Ill. For details, contact secretary, AGA, 420 Lexington Ave., New York 17, N. Y. .....**OCTOBER 17-20, 1949.**

PUBLIC HEALTH MEETING — 77th annual meeting of the American Public Health Association, and meetings of related organizations, at the Hotels Statler and New Yorker, New York City. Dr. Reginald M. Atwater, executive secretary of the Association, 1790 Broadway, New York, N. Y. .....**OCTOBER 24-28, 1949.**

REFRIGERATION SERVICE CONVENTION—12th annual convention, Refrigeration Service Engineers Society, at The Ambassador and Ritz Carlton hotels, Atlantic City, N. J., in conjunction with 6th All-Industry Refrigeration and Air Conditioning Exposition. W. Vernon Brumbaugh, executive secretary of REMA, 1346 Connecticut Ave., N.W., Washington 6, D. C. .....**NOVEMBER 13-16, 1949.**

REFRIGERATION SHOW—6th All-Industry Refrigeration and Air Conditioning Exposition, at Atlantic City, New Jersey. R. K. Hanson, show director, REMA, 1107 Clark Building, Pittsburgh 22, Pennsylvania. .....**NOVEMBER 14-18, 1949.**

ASRE CONVENTION—46th annual convention, American Society of Refrigerating Engineers, at Edgewater Beach Hotel, Chicago, Ill. M. C. Turpin, secretary of Society, 40 W. 40th St., New York, N. Y. .....**DECEMBER 4-7, 1949.**

HEATING AND VENTILATING SHOW—Southwest Air Conditioning Exposition of the International Heating and Ventilating Exposition, State Fair Grounds, Dallas, Texas, under the auspices of the American Society of Heating and Ventilating Engineers. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. .....**JANUARY 23-27, 1950.**

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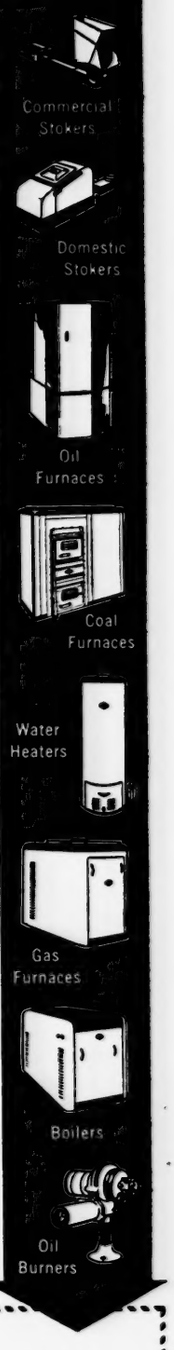

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